

NEUMANN'S CEREBELLAR ABSCESS

BY
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OTITIC CEREBELLAR ABSCESS

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OTITIC CEREBELLAR ABSCESS

I

STATISTICS

THE statistics are discussed in detail in Heimann's work (*A. f. O.*, Bd. 66 and 67, 1905.) Heimann collected all the material which was available at the time when his book was published. I have included only those cases of temporal and cerebellar abscess which have appeared in literature since 1900, together with those observed in Politzer's clinic during the same period.

Heimann gives a proportion of 428 abscesses of the temporal lobe to 198 cerebellar abscesses, or 68·3 per cent. to 31·7 per cent.; my statistics show 336 temporal and 196 cerebellar abscesses, or 63·4 per cent. to 36·6 per cent. The difference is therefore too small to be of special significance.

The relative frequency of occurrence of cerebellar abscess at different periods of life, as calculated by various writers, appears in the following table :

Author.	0-10.	11-20.	21-30.	Over 30.
Koch	11	33	35	19
Okada	17	56	45	28
Körner	4	14	12	10
Heimann	16	57	38	26
Neumann	12	51	41	30

From these numbers it will be seen that, in the great majority of cases, the intracranial complications appear between the tenth and thirtieth year of life. My statistics furnish no new evidence in this connection.

As regards the relationship between otitic cerebellar abscess and the sex of the patient, from the literature we derive the following information :

	Males.			Females.		
Koch	...	...	66 = 66 per cent.	...	36 = 36 per cent.	
Okada	...	...	107 = 83	...	22 = 17	,
Körner	...	...	18 = 60	...	12 = 40	„
Heimann	...	...	117 = 78	...	33 = 22	„
Neumann	...	...	127 = 68	...	61 = 32	„

My statistics, as opposed to those of Okada and Heimann, show a considerably larger proportion of females, though the males are still in a proportion of 2 to 1.

In relation to the relative frequency of the situation of cerebellar abscess on the right or left side, there has been a difference of opinion chiefly due to Körner, Körner's view being that cerebellar as well as cerebral abscess most often occurs on the right side. On the other hand, the statistics of Koch and Okada show no such difference. Heimann and I have also been unable to confirm Körner's view : indeed, the statistics as a whole even demonstrate a preponderance of left-side cases. The numbers in this connection are as follows :

						Right.	Left.
Körner	...	...	...	...	...	37	17
Koch	...	...	...	...	...	53	48
Okada	...	...	...	...	...	73	78
Heimann	...	...	...	...	...	57	85
Neumann	...	...	...	...	...	64	76

As regards the causation of cerebellar abscess, a distinction must be made between acute and chronic cases. In Okada's cases the causative middle-ear suppuration

was chronic in 120 instances (81 per cent.), and acute in 28 (19 per cent.). In 570 cases of otitic cerebral abscess, Heimann found 457 (80 per cent.) cases of chronic, and 113 (20 per cent.) of acute, middle-ear suppuration. In my collection 132 (88 per cent.) were chronic, and 19 (12 per cent.) acute, cases.

Of the last 19 acute cases, there are, in the first place, 4 the description of which is so imperfect that the path of infection cannot be determined from it. Of the remaining 15, 8 also exhibited simultaneous sinus thrombosis (53·33 per cent.). Two of these cases showed a perforation of the median wall of the sinus, leading directly into the cerebellar abscess. In the remaining 6 cases such a direct communication was not demonstrated, though, judging from the description, the sinus thrombosis was primary, and the cerebellar abscess secondary. In 6 cases (40 per cent.) there was an extradural abscess in the posterior cranial fossa. In one case, again, a fistula was present, leading into the abscess; in the other cases the connection was not demonstrable to the naked eye. One case only presented definite signs of labyrinthine suppuration, though even in this instance there was some doubt owing to incomplete investigation.

It therefore follows, if it is allowable to draw any conclusion from the certainly small number of cases, that in the acute cases labyrinthine suppuration plays no rôle in the origination of cerebellar abscess, but that the latter is set up either through the instrumentality of a sinus phlebitis or an extradural abscess of the posterior fossa.

An entirely different picture is presented by the chronic cases, in the majority of which the cerebellar abscess is of labyrinthine origin. I have collected 132 cases of chronic suppuration. In 20 of these the description is

so incomplete that they are worthless; 49—*i.e.*, 43·75 per cent.—showed labyrinthine suppuration, which in 15 cases was due to cholesteatoma, and in the others to middle-ear suppuration uncomplicated by cholesteatoma.

The path of communication from the diseased labyrinth, according to the statements of the various writers, was in 3 cases a deep extradural abscess, in 12 the internal meatus, in 13 the aquæductus vestibuli, whilst in the other cases the route is not clearly given.

Six cases (5·35 per cent.) presented labyrinthine suppuration and sinus thrombosis, the causal factor in 4 being cholesteatoma. Two showed a path of conduction to the abscess through the internal meatus, a similar connection not being demonstrable in the other cases.

It is a recognized fact that sinus thrombosis may be set up from the suppurating labyrinth by way of the aquæductus vestibuli. It is interesting to note that in none of the thirteen cases of conduction through the aquæductus vestibuli did sinus thrombosis exist, whilst, on the other hand, in the 6 cases in which labyrinthine suppuration and sinus thrombosis were co-existent, in one case only in our clinic (169 cases) was attention directed to the possibility of this transmission.

It is here advisable to investigate more closely the importance of the aquæductus vestibuli in relation to the propagation of suppuration from the diseased labyrinth to the cranial contents.

According to Boesch (*Z. f. O.*, Bd. 50), in a collection of 65 cases, the cerebellar abscess originated as follows :

	Times.	Per Cent.
Via internal meatus	32	49·2
Via aqueductus vestibuli	22	33·84
Via porus acust. int. and aqueduct. vest. ...	1	1·5
Via aqueductus cochleæ	2	3·0
Via fistula in semicircular canal	8	12·3

According to these statistics, the aquæductus vestibuli forms the path of conduction in one-third of all cases. A careful analysis of the anatomical reports, by means of which Boesch endeavoured to confirm this extraordinary fact, showed, however, that scarcely one of the cases mentioned would bear critical investigation.

Wagener (*A. f. O.*, 68) has collected 31 cases (including Boesch's 21) in which either an empyema of the sacculus had been set up by way of the aquæductus vestibuli, according to the statements of the authors themselves, or the cases were described by other writers as cases of empyema of the sacculus. Of these cases, 3 only were examined microscopically, the diagnosis of empyema of the sacculus being made from the macroscopical appearances in all the others. Definite details are wanting in the three cases examined microscopically as to whether a connection existed, and, if so, of what nature, between the diagnosed empyema of the sacculus and the microscopically demonstrated pus in the aquæductus vestibuli. It therefore follows that Politzer's case (*A. f. O.*, 65), in regard to which it is stated tersely and precisely that "the ductus and saccus endolymphaticus are filled with pus," is the only case to which no objection can be raised, in which extension of suppuration from the labyrinth between the layers of dura is proved (Passow, *Verhandl. d. Deutschen Otolog. Gesells.*, 1906). The saccus may, however, be infected not only from the aqueduct and the neighbouring carious portions of bone, but also from the sinus, as the latter lies in contact with the bottom of the sinus endolymphaticus. It would be advisable to ascertain definitely the rôle of the aquæductus vestibuli in this connection by a thorough anatomical and histological investigation of appropriate cases.

If we now proceed farther in the discussion of the statistics of my cases of cerebellar abscess due to chronic suppuration, we find sinus thrombosis in 38 cases (34 per cent.), in 16 cases (14.28 per cent.) extradural abscess of the posterior fossa without involvement of the sinus or the labyrinth, in 3 cases extradural abscess and sinus thrombosis. In 26 cases extradural abscess and sinus thrombosis were produced by cholesteatoma, and 7 cases of extradural abscess, without labyrinthine suppuration and sinus thrombosis, were also due to cholesteatoma.

II

ÆTIOLOGY AND PATHOLOGICAL ANATOMY

THE foregoing statistics have already shown that cerebellar as well as cerebral abscesses in general originate in 80 per cent. and more of the cases from chronic suppuration of the middle ear—that is to say, cases in which, as a rule, not the mucosa alone, but also the bone, is affected, or cholesteatomatous formation and absorption of bone has occurred.

Acute processes in the middle ear exhibit only a slight tendency to involvement of the endocranium. This is due to the fact that acute otitis is but seldom accompanied by a noticeable destruction of the tissue of the mucosa of the middle ear, and the intact bony wall forms a protection against the invasion of pathogenic germs. Only, in cases where the inflammation is of great intensity and the infecting agent especially virulent, thrombi are sometimes formed in the vessels of the mucous membrane of the tympanic cavity, which extend into the vessels of the bone,

and may reach the cerebral meninges and sinus. (Macewen, "Die Infektiös. Erkr.," u.s.w., Wiesbaden, 1898).

Although, as a rule, otitic brain abscesses developed in acute middle-ear suppuration are associated with otorrhœa and perforation of the drum, yet it must not be forgotten that purulent inflammation of the middle ear may exist without perforation of the drum and without discharge from the external meatus (Macewen, *loc. cit.*; Schwartz). Macewen reports a case of extensive middle-ear disease, with thrombosis of the sigmoid sinus and caries, but without perforation of the drum. Habermann (*Prager Med. Woch.*, 1885) found in one case tuberculosis of the middle ear and the mastoid cells, with an intact drum. We also have seen numerous cases with extensive disease of the pars mastoidea, and without perforation of the drum. Up to the present time a case of cerebral abscess without perforation of the drum has not certainly been known to occur.

In chronic suppuration of the middle ear the bony wall of the middle ear is also involved. As the bloodvessels in the bone are in intimate anastomotic connection with those of the mucosa, the bone corresponding to the affected portion of mucosa gradually becomes carious or necrotic. Should the source of infection remain, the pathogenic germs find their way through this necrotic broken-down area of bone into the manifold crypts and recesses of the middle ear, the antrum, and the cells of the mastoid process. As a result of the inflammatory irritation there is abundant formation of granulations, which fill the cavity of the middle ear, causing retention of pus and obstruction to secretion. In the further course of the inflammatory process some of the bony septa corresponding to individual pneumatic spaces are absorbed by the luxuriantly proliferating granulations. In consequence of

this the antrum is considerably enlarged, and under certain circumstances it and the tympanic cavity may form a single large cavity. In spite of the enlargement of the cavity of the middle ear owing to absorption of the bony walls, the lumen is considerably reduced by the proliferating masses of granulations. Simultaneously with the absorption there is formation of new bone in other parts of the temporal bone, which leads to eburnization and the filling of numerous cells with dense osseous substance. There is thus proceeding at the same time in the middle ear a process of connective-tissue formation and one of disintegration, so that individual parts are sclerosed, whilst others experience necrotic disintegration. Owing to similar processes in the temporal bone, especially in acute recrudescence or as a result of a recent infection, the suppuration advances towards the cranial cavity. The carious and necrotic processes do not occur with the same frequency in individual parts of the temporal bone. The mastoid portion is most often affected; then follow in diminishing frequency the sigmoid fossa, the tegmen tympani et antri, the pars petrosa, including the internal ear, the posterior wall of the external meatus, the inferior wall of the cavum tympani, and finally the posterior wall of the carotid canal. The earlier view, that the encircling sclerosis in the neighbourhood of the carious and necrotic focus forms a natural protection against the transmission of the infection to the brain and meninges, can be accepted only to a limited extent, as the sclerosing otitis is not always situated between the focus of disease and the middle or posterior fossa, but frequently in the external bone, whilst the necrosis proceeds in the direction of the brain and meninges (Macewen).

As clearly appears from my statistical investigation,

middle-ear suppuration, associated with cholesteatoma, forms the largest contingent of the cases in which the formation of cerebellar abscess is induced. A similar relative frequency is observable in all other otitic diseases of the endocranium. The reason why the emigration of epidermis (cholesteatoma) into the cavities of the middle ear plays so important a rôle in the spreading of the infective process is thus rendered sufficiently clear.

In the first place, cholesteatoma, owing to pressure exerted upon the bony substrata, causes erosion of the bone substance, and thus produces laxity of the tissues. As cholesteatoma furnishes an extremely favourable medium for the growth of microbes, ulceration soon occurs, the area involved by which gradually increases, and extends in the direction of the cranium, this being due to the prevention of the external discharge of pus by the cholesteatomatous masses. The sprouting granulations which result from the chronic suppuration cause absorption and comparative necrosis of the bone, which has already been affected by the pressure erosion. In this case again, simultaneously with the destruction of bone, newly-formed bony substance takes its place, which materially favours the retention of secretion. Experience shows that cholesteatomatous formation occurs preferably in the antrum, so that the processes of destruction and new formation which have been described take place exactly in those regions (median antral wall, labyrinth, sinus) which, according to my statistics, usually come under consideration in relation to the induction of cerebellar abscess.

The reason why the extension of an infective process from the middle ear to the cranial cavity tends in one case to a diffuse meningitis, in another to a circumscribed

process ; why sinus thrombosis, cerebral abscess, or extradural abscess, appear, is dependent partly on the route of infection, partly on the virulence of the infective agent. Suppurative processes of slight virulence tend chiefly to adhesions of the cerebral meninges, which form a dam against the progress of the infection ; whilst, on the other hand, the effects of highly virulent exciting causes evince a tendency to rapid progression, even before adhesion of the disease focus with the meninges takes place. The route by means of which infection from the temporal bone reaches the cranial cavity is of material significance as regards the variety of cerebral complication produced. If the infection travels by pre-existing tracts, diffuse meningitis, due to purulent infection of the meninges, occurs in the majority of cases, before adhesion can take place. Suppuration induced in this manner leads only in the rarest cases to cerebral abscess. The aquæductus vestibuli apparently forms an exception to this rule, as inflammatory processes are propagated in a similar manner to those spreading by way of newly-formed channels. The fistulæ formed by carious destruction advance but slowly towards the cranial cavity, owing to which, with this mode of infection, as a rule localized collections between the cerebral orifice of the bony fistula and the adjacent meninges occur. This applies to the aquæductus vestibuli, the inner opening of which is covered by a layer of dura. If the infection travels by way of the aquæductus vestibuli, as a rule an empyema of the sacculus is formed in the first place, practically an interdural abscess, owing to which adhesions occur between the dura and the soft coverings of the brain in relation to the surface of the cerebellum. Infection via pre-existing tracts (with the exception of the aquæductus

vestibuli) tend therefore to meningitis, whilst infection by way of tracts not previously existing, inclusive of the aquæductus vestibuli, results in circumscribed extradural and cerebral abscess.

These circumscribed collections of pus occupy a median position between meningitis and cerebral abscess, when they form on the inner surface of the dura. Such localized abscesses may exhibit such marked local symptoms that they may be mistaken for cerebral abscess. Their prognosis is, to a certain extent, an unfavourable one, as the original circumscribed suppuration may lead to diffuse purulent meningitis after operative interference.

I am unable to agree with Wolff's opinion ("Beiträge zur Otitischen Hirnabszess," Inaugur. Dissert., Strassburg, 1897) that there are uncomplicated cerebral abscesses. In most cases the encephalitis and meningitis serosa which surround the abscess are not regarded as complications, although, as a matter of fact, many symptoms which appear in the course of the cerebellar abscess owe their origin to such secondary cerebral alterations, due to the abscess. Furthermore, there exists only an ill-defined line between serous and purulent meningitis, and it is difficult to say where the one begins and the other ends. Grunert (*A.f. O.*, 43) and Leutert (*A.f. O.*, 46 and 47) also express themselves to this effect.

Otitic cerebellar abscess in the great majority of cases is a chronic trouble. Weeks, or even months, after the abscess itself has appeared, gradual or rapid increase of the severe general and local symptoms leads to death. The acute exacerbations which appear in the course of cerebellar abscess are due to increase in volume of the abscess focus, wandering cerebral œdema, sudden increase of cerebro-spinal fluid, etc.

It has been demonstrated by the conditions found on section that cerebellar scarcely ever become as large as cerebral abscesses. Owing to proximity to the vital bulbar centres, a fatal termination occurs before the cerebellar abscess has attained any considerable dimensions. Cerebellar abscesses are seldom ovoid in form, but are usually irregular in shape, with numerous prolongations. The latter are frequently of considerable size, and may give the impression of independent abscesses. The cases reported in literature of multiple abscesses in the same hemisphere of the cerebellum may possibly be regarded partially as such diverticulæ of a solitary abscess. The contents of the abscess vary according to its age and the virulence of the exciting cause.

It is in some cases surrounded by a pyogenic membrane, and sometimes is without any sharp line of demarcation from the surrounding brain substance. According to earlier statistics of Heszler ("Schwartz's Handb.," ii.), cerebral abscesses due to chronic middle-ear suppuration are encapsuled in 65 per cent. of the cases, and those due to acute otitis in 38·5 per cent. The zone of brain tissue surrounding the abscess is saturated with œdema, infiltrated with round cells, and passes gradually into normal brain substance. The membrane of the abscess exhibits a histological structure varying according to its age. In recent cases it consists of a fibrillary fibrinous reticulum of loose structure, in the neighbourhood of which reactionary inflammatory processes take place. Subsequently the membrane, owing to proliferation of the fixed connective-tissue cells and neuroglia, as well as vascularization, becomes thickened, and surrounds the focus of suppuration in the form of a thick capsule. Microscopically the surrounding membrane shows a dis-

tinently stratified structure (Preysing, *Z. d. O.*, 35). In abscesses of long standing it is often of a callous consistency, and infiltrated by calcareous concretions. The encapsulation of the abscess is, however, in no way to be regarded as an exclusively healing process, as experience shows that, despite encapsulation, severe disturbances of the cerebral functions may occur, owing to exacerbation of the primary aural suppuration, intercurrent infections, or trauma. In rare cases absorption of the abscess contents occurs, leaving either a cyst filled with clear fluid, or a cicatrix, which consists of connective-tissue or neuroglial elements, according to the size of the abscess (Borst, Ziegler's "Beiträge," etc.). R. Müller (*A. f. O.*, 50) has endeavoured to discriminate various anatomical forms of abscess corresponding to the differing clinical courses of abscesses of the brain. He differentiates those supplied with a limiting membrane, or "interstitial" abscesses, from the "parenchymatous" form, which are without clearly defined borders.

These two forms are distinguished clinically by Müller. The course of the parenchymatous abscess is either afebrile or associated with fever of a septicæmic character, without symptoms of cerebral compression, though in some instances severe symptoms are present, which do not retrogress after evacuation of the pus. On the other hand, in association with interstitial abscess, fever is invariably present, with evening elevations of temperature, symptoms of increase of cerebral pressure, which promptly disappear on evacuation of the abscess. According to Preysing (*A. f. O.*, 51), the varying course of brain abscess is not dependent upon the original anatomical situation of the pathological process, but upon the intensity of the inflammation in relation to the site in which the abscess appears.

Whilst, in cases where the microbes are of a high degree of virulence and the decrease in resistance of the body is more pronounced, tissue destruction is so rapid that encapsulation of the abscess fails to occur, in other cases, where the virulence of the infective organisms is less, and the power of resistance of the body sufficiently strong, time is allowed for the formation of granulation tissue and encapsulation. Whilst I entirely agree with Preysing's opinion, yet I must add that the virulence, and particularly the nature, of the infective germs is of primary importance as regards the anatomical conditions and the clinical course of the abscess.

The importance of the nature and virulence of the infective agent in relation to the anatomical and clinical course of the otitic cerebral process has up to the present time not been properly appreciated. Although numerous investigations have been carried out in connection with the microbes concerned in intracranial suppurative processes, I have been unable to find in the literature of the subject any statement that the histo-pathological and clinical peculiarities are essentially related to the nature of the bacteria.

In the first place, as regards Gram-positive cocci, there are in most cases found in the pus of the abscess, in addition to the usual pyogenic cocci, meningococcus of Weichselbaum, diplococcus of Fränkel-Weichselbaum, and Friedländer's pneumococcus.

The characteristic peculiarity of diplococci, which consists in causing an abundant secretion of fibrin in the blood, is especially prominent in cerebral abscesses produced by these organisms. Within a short time after their entrance into the brain substance, the zone of brain tissue limiting the focus of suppuration is enclosed by

a more or less thick fibrinous structure, the meshes of which contain numerous polynuclear leucocytes. In the course of further development the fibrinous membrane, which is at first delicate, increases in thickness and consistence, until it is finally transformed into a thick, indurated abscess membrane. The cocci manifest this fibrinoplastic power, though to a less extent, even when their virulence is decreased. Especially in those cases where there are marked demarcation and encapsulation processes in the neighbourhood of the abscess, we have chiefly to deal with diplococci. If the latter are associated with other bacteria, the final result depends upon the preponderating virulence of the one or the other species of micro-organism. When the abscess is induced by Gram-negative anaërobic bacilli, an entirely different anatomical picture is exhibited.* Instead of a definite membrane, the abscess has soft necrotic margins, is sharply defined from the surrounding brain substance, and contains semi-fluid necrotic masses and breaking-down detritus. These bacteria are principally found on the margins of the encephalitic focus, and are extra- or intracellular.

As regards the origin of these anaërobic bacteria, they flourish as harmless saprophytes in the buccal cavity, and find their way into the cavum tympani by way of the Eustachian tube. The circumstances under which these microbes acquire a pathogenic power are not yet definitely understood. They certainly exhibit considerable variety in form, though their primary shape resembles that of the influenza bacillus. They are frequently ovoid, with rounded extremities and protruding sides, and no constant

* Our knowledge of these anaërobic bacilli we owe to the valuable work of Ghon (*Centralb. f. Bakt.*, etc., Bd. 41, 1906, and "Beiträge zur Kenntniss der Anäroben Bakterien des Menschen." By Professor Dr. A. Ghon, Dr. V. Mucha, and Dr. R. Müller).

position as regards one another has been recognized. Occasionally they assume the form of diplobacilli. A special characteristic of these bacilli is that they maintain their shape for a very considerable period. The reaction of the nutrient medium, as well as of the temperature, appears to exert no influence upon the cultures. The staining is often bipolar, especially if preparations from young cultures are fixed in alcohol and stained by borax methylene-blue solution. They are immotile and show no flagellæ or spores. There is no definite capsule, though Lugol's stain gives a well-marked outline. These obligatory anaërobic bacteria possess the power of forming, amongst other products, abundant sulphuretted hydrogen. The intensely fœtid stench which proceeds from concentrated cultures of them is also found in the abscesses induced by these anaërobes. If the bacteriological investigation of a fœtid cerebral abscess shows such numerous species of bacteria, one may, notwithstanding, always demonstrate the presence of these anaërobe bacilli in cultures. Whilst the cultures of the other microbes found in abscess pus have no special smell, those of the anaërobes have a penetrating fœtor similar to that of the pus of the brain abscess. The fœtid stench which is present in association with many brain abscesses may invariably be attributed to the presence of anaërobic bacilli. An essential characteristic of such abscesses is their feeble tendency to heal, and the profuse secretion of thin fluid pus, of a dirty grey colour and mixed with abundant shreds of necrotic tissue. In my earlier days I had the opportunity of operating upon an abscess of the temporal lobe, which presented all the pathognomonic signs of such an anaërobic abscess. Neither the free application of hydrogen peroxide nor irrigations with

permanganate of potash were successful in controlling the profuse secretion, and the abscess cavity did not show the slightest inclination to heal. In addition the secretion was intensely fœtid in character. On bacteriological investigation, a pure culture was obtained of these obligatory anaërobic bacilli. It is worthy of note that all animals are refractory to these microbes. It is difficult to say in what way they become pathogenic. Possibly the cholesteatoma of the middle ear may be the elective nutrient medium, acting in association with the deficiency or failure of the supply of oxygen, and thus producing activity of these bacilli.

III

SYMPTOMATOLOGY

THE clinical picture of cerebellar abscess shows but few definite characteristics, so that the establishment of a uniform syndrome for otitic cerebellar abscess presents great difficulty. The parts of the brain surrounding the abscess as a rule experience encephalitic change or œdematous saturation, and the symptoms of irritation and motor (or disturbance of equilibrium) symptoms set up by the last-mentioned alterations interfere with the clinical picture to a considerable extent. Owing to this there are symptoms of increase of cerebral pressure, which in many cases can scarcely be distinguished from those of the cerebellar abscess.

As opposed to the cases with an overplus of symptoms, a not inconsiderable number of cerebellar abscesses run an entirely latent course. According to my statistics, the cases exhibiting no symptoms amount to 9·4 per cent., so

that cerebellar abscesses run a latent course far more frequently than all other varieties of brain abscess.

A. Focal Symptoms.

The focal symptoms of disease of the cerebellum, and therefore those of cerebellar abscess, are due on the one hand to lesion of Deiters' nucleus and the afferent and efferent tracts, and on the other hand to lesion of the sensory tracts,* which belong to the same side of the body, and stand in relation to the co-ordination of muscular sense. The lesion of Deiters' nucleus produces vestibular nystagmus, vertigo, and vestibular ataxia; that of the sensory tracts results in hemiparesis and hemiataxia of the upper and lower extremities on the same side, without loss of conscious deep sensibility.

In this representation of the cerebellar functions, which is only partially included in the textbooks of neurology, I follow the researches of Dr. Bárány,† whose results I can fully confirm from my own observations, and at the same time refer to my work "Upon the Differential Diagnosis between Labyrinthitis and Cerebellar Abscess" (*A. f. O.*, 67).

In the first place, as regards nystagmus, this is always of a rhythmical character, and shows on the whole the characteristics of a vestibular nystagmus, thus according with the description given by Bárány. The differentiation of vestibular nystagmus of cerebellar origin from that originating peripherally in the semicircular canals is made on the one hand by careful functional testing of the

* "Researches on the Rhythmic Nystagmus reflected from the Vestibular Apparatus of the Ear and its Accompanying Symptoms" (*Monats. für Ohrenheilkunde*, 1906).

† *Ibid.*

vestibular apparatus, similar to that carried out by Bárány in our clinic; whilst on the other hand the course of the disease and the accompanying symptoms assist in the diagnosis. Nystagmus due to disease of the labyrinth is, when the disease is circumscribed, at first directed towards the affected side; if the labyrinthine disease progresses, and involves loss of excitability of the vestibular apparatus, the direction of the nystagmus changes. It then inclines towards the sound side, and so continues until the diseased labyrinth is completely destroyed. It then gradually decreases in intensity, until after a short time it entirely disappears. If my labyrinthine operation is performed, by which the whole of the labyrinth is removed, whilst nystagmus towards the sound side persists, on the first day the nystagmus is unaffected, but in two to three days its severity is materially diminished, and subsequently it rapidly disappears altogether.

At the time when the nystagmus goes towards the injured side, the irritability of the labyrinth is normal. On irrigation with cold and hot water the nystagmus described by Bárány appears in a typical form. If on the contrary the nystagmus is directed towards the sound side, as a rule the irritability of the labyrinth is already affected. The nystagmus due to irrigation is only very slight or of short duration, and with more extensive disease the irritability of the labyrinth completely disappears, whilst nystagmus towards the sound side still persists.

As regards the cerebellar nystagmus, the nystagmus also occurs both towards the affected and towards the sound side, though preponderatingly towards the affected side. In the otitic cerebellar abscesses which we have observed during the last few years, in which a thorough

investigation was made as regards nystagmus, there was invariably a combination of cerebellar abscess and labyrinthine suppuration. In these cases the distinction between cerebellar and labyrinthine nystagmus was made in the following manner:

1. It is assumed that, if nystagmus towards the affected side exists, a circumscribed labyrinthitis or a cerebellar abscess may be present.

With circumscribed disease of the labyrinth irritability on irrigation is frequently still normal; at the same time, however, there exist the signs of a labyrinthine fistula. Increased density or rarefaction of air or pressure on the walls of the labyrinth evoke nystagniform ocular movements. In another case irritability on irrigation is abolished, but on the other hand nystagmus is still produced by direct pressure, and galvanic excitability is also still present. Under these circumstances a diagnosis of cerebellar abscess cannot be made from these symptoms previous to an operation upon the labyrinth.

According to the indications worked out by me, and in general use at our clinic, in such cases a conjoint labyrinthine and radical operation is performed. After the labyrinthine operation the nystagmus, if due to the labyrinth, must incline towards the normal side. We have up to the present observed no case of a combination of circumscribed labyrinthine suppuration and cerebellar abscess. If, however, in such a case, after the labyrinthine operation, the rotatory nystagmus should be directed farther towards the affected side, an immediate diagnosis should be made of a cerebellar abscess in relation to disease in the posterior cranial fossa, as a destroyed labyrinth never results in nystagmus towards the same side. Nystagmus towards the normal side, seen after

destruction of a labyrinth, proceeds, according to the view held by Bárány and myself, from the normal labyrinth. If, in spite of destruction of the labyrinth, such as is produced by my labyrinthine operation, the nystagmus is subsequently directed towards the affected side, it must proceed from within the cranium, owing to irritation of Deiters' nucleus or the nervus vestibularis at the base of the brain.

2. Rotatory nystagmus towards the affected side is present. The labyrinth is not irritable. In this case an immediate diagnosis of cerebellar abscess may be made from the origin of the nystagmus in the posterior cranial fossa, if accompanied by corresponding conditions of the temperature and pulse.

3. Nystagmus towards the sound side exists, and the labyrinth is non-irritable; this nystagmus may therefore proceed as much from the labyrinth as from the cerebellum. In these cases it is impossible to make the diagnosis from this symptom before an operation is undertaken on the labyrinth.

If the nystagmus was of labyrinthine origin, it disappears in two to three days after the labyrinthine operation. If, however, it is dependent upon intracranial conditions, it not only persists after the labyrinthine operation, but may increase in intensity, and not seldom the direction becomes reversed, and inclines towards the affected side. In these cases an intracranial origin may be diagnosed with certainty.

Gradenigo's statements are on the whole in accordance with our own. Gradenigo (77 *Versammlung der Naturforscher und Ärzte*) distinguished "nystagmus præcox," which is usually dependent upon labyrinthine lesions, and "nystagmus tardus," which appears as a result of intra-

cranial complications, in most cases in the terminal stage. The nystagmus is a symptom of irritation, which decreases in severity more rapidly than the other symptoms of irritation of the labyrinth (vertigo, subjective aural tinnitus). On destruction of the labyrinth it entirely disappears.

The nystagmus seen in association with endocranial complications, as opposed to the labyrinthine form, first appears in the advanced stages of the pathological process.

As regards the cases found in literature, in forty-nine cases only are there statements as to the presence or absence of nystagmus. According to Bárány, a simultaneous examination of the labyrinth in relation to the excitability of the vestibular apparatus was carried out only in three cases in our clinic. In these this test showed the presence of labyrinthine suppuration, in that irrigation with cold and hot water had no effect on the existing nystagmus. One of these cases is given in detail.

On the whole, in 9 of the cases recorded in literature there was found to be nystagmus towards the normal side; in 17 nystagmus towards the affected side; in 14 the direction is not stated; whilst 9 cases exhibited no nystagmus. As regards the latter, it must be borne in mind that in many cases the nystagmus is noticed only on lateral visual movements, and that all the cases were certainly not examined in this manner, so that in those in which it is stated that nystagmus was not present it might possibly have been overlooked.

The same conditions obtain as in labyrinthine vertigo, the adaptation of the organism to the abnormal irritation as obtain elsewhere. Cerebellar patients also very frequently soon become inured to the persistent nystagmus, and the subjective accompanying symptoms of the nys-

tagmus disappear, to recur only with especially severe attacks.

The ataxia associated with cerebellar disease requires a special description. According to Bárány's view, this is a combination of a vestibular and a specifically cerebellar form. The vestibular ataxia exhibits all the peculiarities of this particular form; that is to say, it stands in exact physiological relationship, demonstrable every moment, to the direction of the nystagmus and the position of the head in regard to the body. If, for example, rotatory nystagmus towards the left side is present, the patient leans to the right on standing upright. If the head is rotated towards the left, he bends forwards; if towards the right, he inclines backwards. Vestibular ataxia is shown most distinctly on testing for Romberg's sign; as a rule it is accentuated when the eyes are closed, and is almost compensated on standing with the legs widely separated. The same remarks apply to walking as to standing. On walking also the position of the head exerts a definite influence. If, when the head is held exactly straight, the patient inclines towards the right side, on rotation of the head to the left he staggers forwards.

The position assumed by the patient in bed also plays a special rôle in the statements of writers. The results of observations at our clinic are as follows: In some cases, which showed constant severe nystagmus towards the affected side, the patient lay upon the affected side. In this position the eyes were directed towards the normal side, and the patient suffered less from vertigo. Looking towards the affected side notably increased the vertigo and the nausea in these instances. As the patients, however, lay with the affected side upon the pillow, there was no inducement to look at the pillow.

In other cases the symptom observed by Oppenheim and Schmidt appears. Certain revolutions of the head result in an attack of vertigo, with severe nystagmus and nausea, whilst when at rest, or with the head in a different position, no nystagmus or vertigo is present.

The appearance of vertigo in association with certain positions of the head and body, of occipital pain and stiffness of the neck, result in a characteristic position of the head and body in cerebellar conditions.

The patient holds the head completely stiff and inclined towards the affected side; on standing up, and often when lying down, he supports the occiput with the hand, or holds the head between the hands. The keeping of the head in a crooked position is regarded by von Beck as an important symptom of cerebellar abscess and extradural abscess of the posterior cranial fossa. I have also had the opportunity of observing this characteristic symptom in a few cases.

As regards the specific cerebellar ataxia, opinions are expressed with reference to it by various writers; we might confirm these from the investigation of a few cases. The observations show that the extremities on the same side exhibit motor ataxia, whilst the testing of conscious sensibility shows no abnormality whatever. Special characteristic indications of this form of ataxia have not as yet been determined with certainty. Babinski found characteristic disturbances in the co-ordination of the muscles (*asynergie cerebreuse*).

Cases of cerebellar abscess are sometimes observed in which hemiataxia without hemiparesis is present; in most cases, however, there is also hemiparesis on the affected side. Opinions are still divided as to the origin of the hemiparesis on the same side. Some writers ascribe it to

the remote effects of the cerebellar disease upon the pyramidal tract, whilst others consider hemiparesis on the same side to be a focal cerebellar symptom (Pineles, Monakow), the latter being apparently the correct view.

In cases where paresis of the opposite side is present, remote effects on the pyramidal tract may usually be assumed.

In literature only very scanty records are found in reference to hemiataxiæ and hemipareses. Hemiataxia of the affected side is mentioned in two cases, hemiparesis of the affected side in four.

Whether weakness of the trunk muscles, which is not seldom observed in association with cerebellar disease, is a focal symptom of the cerebellum must be left undecided. I have seen it in two cases.

Trophic Disturbances.—The rapid and extreme emaciation and pallor seen in a comparatively large number of cases of cerebellar disease are, according to Luciani ("Das Kleinhirn," Leipzig, 1893), due to trophic disturbances, dependent upon deficiency of cerebellar functions. Although this view still requires confirmation, there is nevertheless no doubt that the rapidly increasing atrophy of the skeletal musculature frequently bears no proportion to the diminution in quantity of the nourishment received, especially if the abscess runs an *apyretic* course. As regards the frequency of occurrence of these disturbances of nutrition, they were present in 37 out of 40 cases reported by Okada, though my statistics certainly show only 6·5 per cent.

This symptom is almost always absent in association with cerebellar abscesses which develop in the course of acute middle-ear suppuration.

B. General Symptoms.

To consider first those symptoms which are dependent upon the suppuration. Elevation of temperature is, as a rule, absent in uncomplicated cerebellar abscess. Even in the rare cases where an initial rigor occurs at the onset of the cerebellar abscess, the temperature curve is normal or subnormal. Out of my collection, 61 cases had a febrile course, and 85 an afebrile one. The reason why uncomplicated cerebellar abscesses run their course with a subnormal temperature has as yet not been ascertained. Nothnagel ascribes it to a remote effect of the abscess upon the supposed temperature-regulating nerve apparatus in the corpora restiformis and other parts of the brain. Leutert (*A. f. O.*, 47) has traced the fever to a transitory serous meningitis. The reason for its occurrence, according to Leutert, is that if there is incomplete encapsulation of an abscess, or if the inflammation passes beyond the capsule, the soft cerebral membranes become inflamed.

Hoffmann (*Verhandlungen der Deutschen Otologischen Gesellschaft*, 1906) opposes Leutert's view, and points out that the fever appearing in the course of an uncomplicated cerebellar abscess is invariably dependent upon a concomitant circumscribed purulent meningitis. In three cases of cerebellar abscess he could trace the elevation of temperature to a circumscribed purulent meningitis. According to our experience, the fever occurring in the course of a cerebellar abscess may be due to a variety of causes. These are found either in the primary suppurative focus in the temporal bone or in the cerebral process itself. In the former case the temperature goes down after the relief of the retention in the temporal bone. If

the fever is due to the cerebral abscess, it may be due either to a complicating sinus thrombosis or to purulent or serous meningitis, respectively. Whilst a complicating sinus thrombosis may be inferred from the presence of other characteristic symptoms, the distinction between serous and purulent meningitis presents great difficulties. In this respect the condition found on lumbar puncture is only valuable to a slight extent. On the one hand the results of puncture may be negative, both microscopically and as regards cultures; whilst on the other hand the fluid obtained by punctures sometimes shows flocculent opacity, with the presence of numerous polynuclear leucocytes, when serous meningitis exists. The latter condition is seen especially when the abscess is in a peripheral position, the increased leucocytic content being due to chemiotactic influence. (Details of lumbar puncture are given under Differential Diagnosis.) The cause of the onset of fever can be determined only by the clinical course. If the temperature falls promptly on removal of the causal cerebral abscess, meningitis serosa is present. In cases of circumscribed purulent meningitis, the fever persists after operative evacuation of the abscess. It never, however, attains a high degree, and gradually disappears in cases which tend to heal.

Loss of appetite, exhaustion, *fœtor ex ore*, and furred tongue, are also included in the symptoms which may be produced by the purulent condition. In this relation, however, there are no special distinctions from other severe purulent affections.

C. Remote Effects.

The remote effects appearing in connection with cerebellar abscess are dependent upon the following

mechanical factors. Intracranial pressure is increased by the abscess, and the cerebro-spinal fluid placed under increased tension. This rise of pressure is distributed in a fairly proportionate manner throughout the whole amount of the fluid. On the other hand, however, the pressure is also transmitted through the soft cranial parenchyma, and owing to this the distribution of the pressure is unequal, on account of the more solid consistency of the brain substance, this being pre-eminently the case in the zone surrounding the suppurative focus. The deleterious influence of the inflammatory œdema accompanying the abscess is also a contributory factor.

According to Körner, cerebral symptoms are not observed as remote effects of a cerebellar abscess on the cerebrum, or cerebellar symptoms as remote effects of a cerebral abscess upon the cerebellum. Körner ascribes this to the fact that the tentorium opposes a firm barrier against the extension of the effects of pressure to the cerebrum. According to Macewen, pressure effects due to a cerebellar abscess, as a rule, extend farther into the vertebral canal, in the sense that the medulla in relation with the upper segment of the spinal cord experiences compression.

Sensory Disturbances are not dependent upon mechanical factors, but may often be traced to toxic influence. The patients, especially in the later stages, exhibit a peculiar psychical condition, characterized by the increased stimulation requisite for each cerebral function and lessened capability of apprehension, as well as great desire for sleep. Delayed association, apathy, hesitating speech, forgetfulness, absence of mind, etc., are not rarely observed. In association with these symptoms there is a more or less marked decline of intelligence and persistent

somnolence, which may alternate with great restlessness and jactitation. In other instances the patients show an extraordinary change of character. Maniacal and hypochondriacal delirium is seen in some cases.

The condition of the pulse is significant. In most cases there is pronounced bradycardia, which may sink as low as thirty beats per minute. There is sometimes a quite unreasonable disproportion between the slight extent of the compression process in the cranial cavity and the extreme slowness of the pulse. Under these circumstances we must assume that either a collateral œdema or a toxic neuritis is present. It should nevertheless be borne in mind that slowing of the pulse is frequently associated with many cerebral processes. Tumours, extensive blood extravasations, meningitis, and, in general, all conditions associated with intracranial increase of pressure, may cause slowing of the pulse. The want of parallelism between the temperature curve and the frequency of the pulse is also worthy of note. Even when cerebellar abscesses run an extremely febrile course, the frequency of the pulse is scarcely ever proportionate to the temperature. On the other hand, in those cases where the frequency of the pulse increases proportionately to the temperature, the former is dependent upon retention of pus in the primary focus of disease, and stands in no causal relationship to the cerebral abscess.

Arhythmia of the Pulse is among the more common symptoms of cerebellar abscess, though it is most marked in the early stages of the condition. It has no diagnostic significance, as it may also be the prodromal symptom of other cerebral process (meningitis tuberculosa, etc.).

Respiration is affected in rare cases of cerebellar abscess. The Cheyne-Stokes phenomenon first appears in the

terminal stage. Sudden death from arrest of respiration is extremely common.

Headache is present in almost all cases of cerebellar abscess. It is usually constant, and, in many cases, of varying intensity. Frequently it is only slight, and consists rather of a sensation of dulness and heaviness in the head, whilst in other cases it is extremely severe. Sometimes the persistent boring pain in the head is the only symptom which directs attention to the cerebral abscess. In some instances the site of the pain exactly corresponds to the localization of the abscess. Thus, in the cases collected by Okada, one-third were distinguished by localized occipital pain. My statistics as a whole are completely in accordance with the statements of Okada. The site of pain, however, does not always correspond to the position of the lesion. According to Körner, in 21 cases of cerebellar abscess the pain was in 8 exclusively confined to the occiput, whilst in 5 cases of abscess of the temporal lobe pain was also localized in the occiput. Okada considers fixed occipital pain to be a "chief differentiating symptom," and Politzer emphasizes the importance of this symptom in latent forms of abscess. Nevertheless, persistent occipital pain is naturally also observed in association with other processes of the posterior cranial fossa, such as deep extradural abscess and circumscribed meningitis. The occipital pain frequently results in a peculiar position of the head and body, which is sometimes so characteristic that Okada assumes that an approximate diagnosis may be made from this symptom alone. On the other hand, some writers ascribe this peculiar position of the head to involvement of the labyrinth. In this connection it is worthy of note that the headache is sometimes exclusively limited to the fore-

head. My statistics include 17 cases in which this was noted.

Krause explains the frontal headache, which is extremely often observed in association with processes of the posterior cranial fossa, by the following anatomical considerations. The tentorium cerebelli is innervated from Arnold's recurrent branch of the first branch of the fifth cranial nerve, and this branch also supplies the wall of the superior petrosal sinus. On the other hand, however, the first branch of the fifth cranial nerve innervates, by means of the anterior meningeal branch of the ethmoidal nerve, the dura in the region of the posterior cranial fossa and the frontal region. If suppuration occurs in the posterior cranial fossa, especially if it be located in the neighbourhood of the posterior pyramidal surface, the sensory nerve branches passing into the tentorium are irritated, and the extension of the irritation to other branches of the same nerve branch (trigeminus I.) is a well-known physiological fact.

Susceptibility to Percussion of the affected portion of the skull is a very vague and doubtful symptom, as pain on pressure over or behind the temporal bone simply demonstrates an inflammatory process in the deep tissues. According to von Bergmann, susceptibility on percussion is only of value in the diagnosis of a cerebral abscess if it is limited to a strictly circumscribed portion of the scalp in relation to the postero-inferior parietal region. According to Hessler, this symptom is of more value than headache in relation to the differential diagnosis, whilst Jansen always omitted to notice it in his cases. Von Beck, in a number of closely investigated cases, observed pain on pressure at a point four fingers' breadth behind the mastoid process. As regards my own collection, in approximately

a third of the cases there was pain on pressure in the occipital region. Naturally, however, this symptom also may be dependent upon other processes in the posterior cranial fossa (meningitis, sinus phlebitis, extradural abscess).

In many cases it is extremely difficult to determine whether one is dealing with undue susceptibility to percussion of the skull-cap or hyperæsthesia of the scalp. I am acquainted with three cases of cerebellar abscess (Reinhardt, Vohsen, and Panse) in which hyperæsthesia of the scalp was present.

Stiffness and Susceptibility to Pressure of the Neck is not an uncommon symptom in cerebellar abscess, as it is also in other conditions of increase of tension in the posterior cranial fossa. The characteristic position of the head in cerebellar disease, which is described by various writers, is frequently due to stiffness of the neck. The cause of this stiffness has not as yet been definitely ascertained; extension of the cerebral pressure to the upper portion of the spinal cord has been blamed, especially compression of the posterior roots of the upper cervical nerves.

Vomiting is amongst the most important symptoms of cerebellar abscess. Its diagnostic significance, however, is limited, owing to the fact that it is an initial symptom in almost all septic infectious processes. Vomiting occurs more often in cases of cerebellar abscess than in those of abscess of the temporal lobe. According to Barker, this is due to the more frequent combination of cerebellar abscess than of abscess of the temporal lobe with sinus phlebitis, as the latter always causes vomiting. In my opinion, however, it depends upon the involvement of the vestibular apparatus in relation to Deiters' nucleus, as

vestibular irritation certainly very often leads to vomiting. The nervous origin of the vomiting is obvious, as it is absolutely independent of the ingestion of food, and is often unaccompanied by nausea. Körner distinguishes the initial vomiting which is seen in association with almost all septic processes from that which appears in the later stages of cerebral abscesses, which is ascribed to increased cerebral pressure. The initial vomiting is usually associated with rigor and fever, whilst the cerebral vomiting first occurs in more advanced phases of the condition, even in the afebrile stage.

Changes in the **Fundus Oculi** are common accompanying symptoms of otitic endocranial complications. Zaufall (*Prager Med. Woch.*, 1881) did not fail to observe them in any of his cases of cerebral complications. Hansen (*A. f. O.*, 53) thus summarizes the results of an extensive series of investigations as showing that the appearance of optic neuritis or choked discs in the course of middle-ear suppuration invariably indicates the presence of endocranial disease. Jansen (*A. f. O.*, 36) and Körner (*Z. f. O.*, 23) take a diametrically opposite view. According to Jansen, choked discs are also seen in rare cases in association with uncomplicated empyema of the mastoid process and otitis media respectively. Körner explains this as due to extension of the inflammation to the lymphatic vessels passing to the middle ear from the vascular region of the ocular nerve by way of the carotid canal. Bezold ("Handbuch des Ges. Augenheilkunde," by Gräfe-Sämisch, 1903), amongst 100 cases of acute otitis media or empyema of the mastoid process, found changes in the fundus oculi in 23, in 10 of which there was uncomplicated empyema of the mastoid process. Schubert (*ibidem*) expresses a similar view. He was able to observe transitory changes

in the fundus even in spontaneously healing acute otites. Out of 7 cases of endocranial complications, Tenzer (*A.f.O.*, 63) failed to find changes in the fundus oculi once only. According to Schwartze, changes occur in the fundus oculi in 42 per cent. of brain abscesses. These alterations in the fundus oculi are in the great majority of cases of a transitory nature, and lead only in the rarest instances to permanent injury of the power of vision.

As a rule, one notes the presence of a simple non-degenerative neuritis, with capillary hyperæmia of the papillæ and partial obliteration of the papillary margins. Choked discs are decidedly more common with cerebellar than with temporal lobe abscesses, owing to the fact that the sinus circulation is more abundant in the posterior cranial fossa.

A consecutive amblyopia or amaurosis is most often observed in children, and is probably due to hydrocephalus internus. As regards differential diagnosis, it should be pointed out that in children the presence of choked discs is more in favour of tumour (tubercle); optic neuritis, of abscess. The alterations generally affect the side of the diseased ear, though they are often bilateral or localized on the sound side. After evacuation of the abscess rapid involution usually results, although the condition may also assume an eminently progressive character, and give rise to severe visual disturbances. The changes in the papillæ certainly are of no prognostic importance, as they appear with similar frequency in slight and severe cases, and bear no proportion to the nature and size of the causal constricting process. In many cases the onset of the papillitis occurs after cessation of the dangerous symptoms and evacuation of the abscess, so that the alterations in the fundus oculi might

well be ascribed to toxic influences. According to our experience, great diagnostic importance is to be ascribed to optic neuritis and choked discs respectively, in so far as they indicate the existence of endocranial complications. In the cases collected by me, changes in the fundus oculi were present on the side of the affected ear in 26 cases, in 2 on the sound side; in 37 the fundus of both eyes was normal, and in 12 both sides were affected.

Abnormalities of Innervation of the Ocular Muscles and Pupils are included amongst the remote effects. As regards the former, I had the opportunity of observing four cases with visual paralysis. All these four cases had the common characteristic that the field of vision was limited towards the affected side; in one case there was visual paresis towards both sides, although it was more pronounced towards the affected side. This patient also had almost complete visual paralysis in an upward direction. In the literature of my cases two further cases are described with visual paresis towards the affected side. With reference to abnormalities of the pupils, I was able to observe unilateral as well as bilateral mydriasis, these being probably due to remote effects on the corpora quadrigemina and the most anterior portion of the optic thalami.

Strabismus, which is dependent upon disturbances in the region of the optic thalami, is also included amongst these symptoms. In some cases it appears in the initial stage, whilst in others it is first observed in later stages of the condition. In rare instances the strabismus persists, after exposure of the middle-ear cavity and operation on the abscess, after the other cranial symptoms have disappeared.

Ptosis also is one of the rare symptoms of cerebellar

abscess. In doubtful cases it is rather in favour of the localization of the abscess in the temporal lobe, but no such case is included in my statistics.

Conjugate Deviation was observed in a few cases. Under certain circumstances it may be of diagnostic importance, especially if it is associated with nystagmus towards the affected side. Experience shows that rotation of the eyes towards the normal side results (four of my cases).

It ought certainly to be pointed out that the constrained position of the globes is only of value in a diagnostic sense in the early stages of the disease, because in the terminal stage it may also be produced by purulent meningitis. Paralysis of the abducens is observed only in extremely rare cases, and almost without exception affects the homolateral sides (three of my cases).

Disturbances of function in relation to the organ of hearing form a very important constituent of the clinical picture of cerebellar abscess. Jansen was the first to demonstrate that most cases of cerebellar abscess begin with disease of the labyrinth. Further researches have fully confirmed Jansen's statements.

As before mentioned, it is seen from my collection that, in 132 chronic cases of cerebellar abscess, 55 were complicated by suppuration of the labyrinth. As, however, in a considerable number of cases other complications, such as sinus thrombosis, extradural abscess, etc., were present in addition to the labyrinthine disease, it was not possible to accurately determine in what percentage of the cases the labyrinthine suppuration furnished the determining cause of cerebellar abscess. According to our investigations, approximately a third of them might be of labyrinthine origin. It therefore goes without saying that a

large proportion of cerebellar abscesses are combined with severe alterations in the hearing power.

A thorough testing of hearing is therefore indispensable in all cases, as by this means only could the genesis of the cerebellar abscess be accurately determined.

Here we must once more refer to the thorough functional testing of the vestibular apparatus. As I shall enter into this in detail in a work which will shortly appear on labyrinthine suppuration, the demonstration of the absence of excitability of the vestibular apparatus on irrigation of the ear with cold and hot water is of much more value in relation to the diagnosis of labyrinthine suppuration than is the demonstration of deafness. The latter condition is very often produced by toxic conditions in the presence of a normally excitable vestibular apparatus; while, on the contrary, we have observed no case of chronic middle-ear suppuration, in which excitability is absent, without labyrinthine suppuration.

Facial Paralysis may originate from pressure of a cerebellar abscess at the point of entry of the nerve into the internal auditory meatus. In this variety of facial paralysis the soft palate is involved, and it is thus distinguished from the facial paralysis which is due to disease of the section of the facial nerve which is situated peripherally to the geniculate ganglion. Furthermore, a facial paralysis may be caused by the remote effects of a cerebellar abscess upon the pons or an abscess situated within its substance.

In these cases, then, there exists a central, unilateral, crossed, or bilateral facial paralysis. In isolated cases spasms in the region of the facial nerve are also observed in association with the facial paralyses. In Politzer's case the spasms appeared shortly before death, whilst in

Feinberg's case the spasms were present a week before the complete facial paralysis. In most cases the facial paralysis must certainly be referred to a causative process in the middle ear.

Disturbances in the region of the nervus accessorius are observed only in the rarest cases. In a case reported by Katz, in addition to slowing of the pulse and paralysis of the abducens, there was rhythmical contraction of both sterno-cleido-mastoid muscles. As regards the nervus trigeminus, trismus was seen in some cases in association with neuralgia. It was due to remote effects of a cerebellar abscess upon the Gasserian ganglion. Trismus, however, was more often met with in connection with abscess of the temporal lobe.

There is still great diversity of opinion amongst writers as to the occurrence and diagnostic significance of alterations in reflex excitability. According to Bruns, Mendel, and Strümpell, the patellar reflex is abolished when the cerebellum is affected, whilst according to Oppenheim it is generally retained. Koch attributes great importance to loss of the patellar reflex, from the point of view of differential diagnosis from abscess of the temporal lobe. My cases show that the patellar reflex may be abolished in abscess of the cerebellum, and in other instances normal or more active. Judging from our experience, the condition of the patellar reflex does not come into consideration in relation to diagnosis. Our observations agree, on the whole, with those of Okada, which have been already referred to.

Articulatory Disturbances of Speech in connection with the cerebellum (dysarthria, anarthria, etc.), exhibit bulbar characters, and depend upon the remote effects of the abscess upon the medulla.

Cerebellar abscess may, further, cause dysphagia, with or without sensory disturbances, this symptom being due to pressure effects on the pons. Abnormalities in the uropoietic system are not infrequently associated with cerebellar abscess. In this connection, retention and incontinence of urine chiefly come into consideration. Whilst the former is usually seen in advanced stages of the disease, the latter appears, as a rule, at the commencement of the pathological process. Incontinence is a constant associated symptom of cerebro-spinal meningitis, and is also not infrequently present in circumscribed meningitis of the posterior cranial fossa and the upper portion of the spinal cord. As regards alterations in the constituents of the urine, in a few cases albumin, peptone (Brieger, Oppenheim), and sugar (Macewen), have been observed.

IV

INITIAL STAGE

THE chief characteristic of the initial stage of cerebral abscess is that in it symptoms appear which may equally well be produced by the causative disease in the temporal bone, and at least do not permit of a definite diagnosis of intracranial complication. If the existence of a cerebral abscess is subsequently ascertained, one is often able to transfer certain symptoms, which were originally ascribed to the aural disease, to the cerebral abscess. The symptoms present in the initial stage may, naturally, only be suggestive of the symptoms in what we may term the manifest stage.

A rigor frequently accompanies the onset of the initial

stage, although this may be related to the primary aural condition, and a long-persisting pyrexia in the initial stage may also be due to the latter. More commonly, however, the temperature is normal or subnormal, and there is usually pain in the ear and head, the latter being localized to the occiput. A definite diagnosis, however, cannot be made from the last-mentioned symptom alone, nor from slight susceptibility on palpation and stiffness of the neck. Slowing of the pulse is not present. A characteristic drowsiness is repeatedly observed, and owing to this the appearance of the patient suggests a more severe illness than that for which the aural process is responsible. Attacks of vertigo are common, though in rare cases only can they be positively referred to the cerebral abscess; choked discs and severe disturbance of the ocular muscles are not observed. There is often slight nystagmus, and possibly a suggestion of hemiataxia.

V

MANIFEST STAGE

IN the manifest stage all the focal and remote symptoms characteristic of cerebellar abscess, and which have been previously described in detail, definitely manifest themselves. The headache often increases in intensity, but in many cases subsequent encephalitis causes its diminution. There is distinct susceptibility on percussion, and stiffness of the neck, with the resulting characteristic position of the head. Vomiting and frequent attacks of vertigo occur, though, on the other hand, adaptation of the centres to existing conditions may lead to severe

nystagmus, and thereby to cessation of the vomiting. Hemiataxia and hemiparesis are definitely established; optic neuritis develops. The temperature remains normal, whilst the frequency of the pulse decreases. Respiration becomes characteristic, and is much accelerated or of the Cheyne-Stokes type.

The nystagmus, especially in the later stages, is accompanied by paralysis of the ocular muscles and visual paresis, with abnormalities of the pupils; speech assumes a bulbar character; there is difficulty in swallowing, and the original drowsiness is replaced by complete somnolence.

There is difficulty in rousing the patient and making him answer questions, and he is often not conscious of his surroundings. Bodily weakness increases, so that the patient is obliged to remain in bed; the bladder and rectum become affected, and there is incontinence of urine and fæces. There is insufficiency of absorption of food, which is not properly masticated. If treatment is not soon undertaken, the patient enters into the terminal stage.

VI

TERMINAL STAGE

CASES of otitic cerebellar abscess, exclusive of those in which operative or spontaneous evacuation takes place, almost without exception have a fatal termination. As a rule, the cause of death consists in rupture of the abscess wall, and effusion of the pus into the ventricles or upon the surface of the brain. Not infrequently the patient succumbs to a sudden arrest of respiration, due to inflammatory œdema in the area of the bulbar centres. In my

collection ten such cases are found in which death occurred suddenly. In a case reported by Knapp, in which respiratory paralysis was present, artificial respiration was undertaken and continued for forty-eight hours, until death finally resulted from arrest of cardiac function.

If the pus penetrates into the ventricles or the meningeal spaces, an acute inflammation is induced, which spreads extremely rapidly. In a considerable proportion of the cases, however, there is no rupture of the abscess membrane, but inflammation spreads by continuity of tissue from the inflamed cerebral zone surrounding the abscess, to the adjacent meninges, and sets up a patch of leptomeningitis, which extends rapidly. These new endocranial complications are indicated by the following series of symptoms: General restlessness, vomiting, transitory conditions of paralysis and irritation of individual ocular muscles, vasomotor disturbances in the form of red spots, *tâches cérébrales*, dermographism; symptoms of irritation, such as opisthotonos, trismus, tetanic and clonic muscular contractions, delirium, prostration, increased frequency of the pulse as a result of paralysis of the vagus, rise of temperature, and tachypnœa.

On rupture of the abscess and effusion of the pus into the ventricles, these symptoms appear with apoplectiform rapidity. Dilatation of the pupils attains the maximum degree, the temperature rises to 40° or 42°, and respiration becomes extremely frequent and shallow. Tonic and clonic spasms involve almost the entire musculature, the action of the heart is irregular (*delirium cordis*), and deepening coma merges into a fatal result. There are in literature isolated records of a small encapsuled cerebral abscess remaining for a long time in the brain substance as a *caput mortuum* without giving rise to any symptoms.

Such a state of affairs cannot be admitted to be within the bounds of possibility. After absorption of the abscess contents and calcification of the pyogenic membrane, the pathological process may be regarded as concluded. But, still, such a focus always forms a *locus minoris resistentiæ*, and acute recrudescence may be set up in it by what would otherwise be an unimportant infectious disease. I therefore agree with von Bergmann that such a process should not be described as spontaneous healing, for the results of experience show that an abscess not only increases in circumference after encapsulation, but the virulence of the infective agent persists for a very long period.

If the pus of the abscess finds an outlet from the cranial cavity by way of pre-existing or not artificial tracts, spontaneous healing may occur after evacuation of the contents. Macewen mentions a case of cerebellar abscess in which a fistula led into the abscess cavity through a perforation in the sigmoid fossa avoiding the obliterated sigmoid sinus, this perforation being the result of caries. In a case reported by Pollak, the abscess ruptured externally through a dehiscence of the tegmen tympani.

In a case published by Mück (*Zeitschrift für Ohrenheilkunde*, Bd. 37), the abscess ruptured spontaneously into the antrum. It should, however, be borne in mind that the fistulous canal may be lined with granulations, and its lumen may be so narrow that complete evacuation of the abscess pus does not result. In such a case the fistula forms a permanent portal of invasion for pathogenic microbes, which reach the cavum cranii through the fistulous canal, and may induce fresh complications.

VII

DIAGNOSIS

THE diagnosis of otitic cerebellar abscess presents, as a rule, the greatest difficulty. The clinical picture associated with cerebellar abscess is usually so indefinite and doubtful that the diagnosis of cerebellar abscess before operation is only a presumptive diagnosis, especially if time for prolonged clinical observation is not allowed, and an accurate history is wanting. Many of the symptoms of cerebellar abscess are present in every intracranial complication. It shares a few symptoms with temporal lobe abscess, and many of the symptoms are common to it and labyrinthine suppuration. Special difficulties may arise if bilateral aural suppuration exists, and it is necessary to decide which side is to be operated upon. These, however, are only rare and exceptional cases. If a patient is admitted to the hospital with dangerous cerebral symptoms, there is frequently no possibility of waiting sufficiently long for a positive diagnosis to be made, and in many cases operation must be undertaken immediately. In such instances the *intra-operationem* condition may be helpful, as, for example, where a labyrinthitis is combined with a deep extradural abscess, and not infrequently a fistula in the dura is already present. But where no such fistula exists, the dura of the median cranial fossa, which is first exposed, may be completely intact. On exposure of the dura of the posterior cranial fossa, severe changes are found, and one decides, having regard to the dangerous condition of the patient, which is not explained by the extracerebral suppuration, upon immediate exploration of the posterior cranial fossa—that is

to say, incision of the dura and puncture of the brain. If the cerebral symptoms are not very pronounced, a short time may be allowed to elapse after the radical operation until the symptoms of the cerebral abscess become distinct. In this stage almost all aurists would recommend lumbar puncture as a means of obtaining information as to the character of the cerebral changes.

Leutert (*Münchener Med. Wochenschrift*, 1897) observed an increase of polynuclear leucocytes in meningitis, in association with increased pressure of fluid and opaque consistency of the liquor cerebrospinalis. The microscopical demonstration of the irritating factor is of importance, as the examination of cultures and experiments on animals often give a negative result, owing to attenuated virulence of the bacteria. It is therefore advisable to centrifugalize the fluid immediately after its withdrawal, and to search for micro-organisms. If the puncture fluid contains a mixture of microbes and formative elements, and the liquid readily coagulates, tuberculous meningitis is present. The diagnosis of tuberculous meningitis becomes more probable if lymphocytes are demonstrated in the sediment. The presence of polynuclear leucocytes is in favour of purulent meningitis. If the puncture fluid is clear as water, and contains no other formative elements in addition to sparsely scattered mononuclear leucocytes, the results of culture and animal experiments being negative, the conditions may be regarded as normal. Nevertheless, it should be borne in mind that a negative result of lumbar puncture by no means excludes the presence of diffuse purulent meningitis, as communication between the subarachnoid space and the fourth ventricle may be abolished by occlusion of Magendie's foramen. On the other hand, however, an

increased leucocytic content is not invariably in favour of meningitis. If the cerebral abscess is in a peripheral situation, in the neighbourhood of the cortex, increase of the polynuclear leucocytes may be dependent upon chemiotactic influence, without the presence of meningitis. The fact that the bacteria are often not demonstrable in the puncture fluid is accounted for in the following manner: That in many cases, particularly in the presence of recent meningitis, the leucocytes increase as an expression of the existing inflammation, although, on the other hand, no bacteria are found at the site of puncture, which is at a considerable distance from that of the primary disease. A negative result may also be explained by the fact that the pus of an encapsuled cerebral abscess may be free from bacteria. The albumin content of the puncture fluid is increased in cases of cerebral abscess and purulent meningitis, whilst the proportion is normal in serous meningitis.

A negative result of puncture should under no circumstances influence our therapeutic measures. The improvement in the subjective and objective symptoms observed after lumbar puncture is probably dependent upon the following factors: That on the one hand a portion of the irritating agent and its toxic products is evacuated, whilst on the other hand the transudation of fresh lymph loaded with bactericidal material is stimulated by the sudden decrease of pressure. According to Kümmel ("Beiträge zur Ohrenheilkunde," 1905), Heine (*Archiv für Ohrenheilkunde*, Bd. 50), Grossmann (*Archiv für Ohrenheilkunde*, Bd. 64), and Hinsberg (*Zeitschrift für Ohrenheilkunde*, Bd. 38), an intracerebral abscess may increase considerably after lumbar puncture, owing to the altered conditions of pressure. These writers believe that the

localized suppurative focus, surrounded by an encephalitic zone of demarcation, becomes diffuse as a consequence of the sudden removal of pressure, and in part induces fresh suppuration by way of the bloodvessels and perivascular lymphatic sheaths, and in part gives rise to meningitis and ventricular hydrops.

Ziem (*Archiv International*, 1905), on the basis of anatomical considerations, endeavoured to prove the injuriousness of lumbar puncture. In my collection the results of lumbar puncture were positive in 42 cases, and negative in 25. The following microbes were found: Meningococcus of Weichselbaum, *Bacillus pyocyaneus*, and other anaërobic bacteria, diplococcus of Friedländer, the influenza bacillus, bacillus of Fluegge, and tubercle bacilli. As regards my own investigations, I was unable to disprove the results of lumbar puncture in a single case.

VIII

DIFFERENTIAL DIAGNOSIS

WHEN the symptoms of the intracranial complication are fully developed, the differential diagnosis as to the position and nature of the process must be made.

As regards differential diagnosis, sensory and optic aphasia, hemianopsia, symptoms connected with the internal capsule, hemianæsthesia and hemiparesis of the opposite side, indicate abscess of the temporal lobe. Symptoms related to the optic nerve are also produced by cerebellar abscess, though they do not exhibit the characteristics of hemianopsia. The disturbances of speech seen in association with cerebellar abscess are of a bulbar

character, in contradistinction to the sensory or motor aphasia of temporal lobe abscess. As a rule, hemiparesis affects the same side in cerebellar abscess, whilst it involves the opposite side in abscess of the temporal lobe.

Abnormalities of the ocular muscles occur both with temporal lobe and cerebellar abscess. Ptosis, paralysis of the abducens, and complete oculomotor paralysis, are often associated with abscess of the temporal lobe. Paralysis of individual ocular muscles and visual pareses occur with cerebellar abscess. Nystagmus is very rare in connection with temporal lobe abscess, unless the latter is situated in the posterior portion of the temporal lobe, towards the occipital lobe. In cerebellar abscess it sometimes manifests the characteristics of the detailed description previously given.

In cerebellar abscess the headache is localized in the occiput or forehead—in temporal lobe abscess more in the parietal region. Stiffness and susceptibility to pressure of the neck are very common in cerebellar abscess, but in rare cases, however, occur also with large abscesses of the temporal lobe.

The differential diagnosis from labyrinthine suppuration has been already referred to in the description of nystagmus. In many cases one has not strictly to deal with the differential diagnosis between labyrinthine suppuration and cerebellar abscess, but with the recognition of a cerebellar abscess complicating suppuration of the labyrinth. In this connection, the testing of the irritability of the labyrinth, the precise observation of the direction of the nystagmus, and its increasing or decreasing severity, play the most important rôle. We have never observed hemiataxia and hemiparesis in cases of labyrinthine disease. Severe headache also points to the presence of

a complication, though one may also be dealing with a serous or circumscribed purulent meningitis.

The differential diagnosis from meningitis is often very difficult in the initial stage; one of the more important distinctions is the condition of the temperature. Meningitis ordinarily exhibits high temperatures, although a cerebral abscess may occasionally be associated with them. All the symptoms which result from the limitation of space in the posterior fossa may also occur with circumscribed meningitis of the posterior cranial fossa, although we have certainly not yet observed hemiataxia in such cases. Nystagmus of a similar character to that seen in cerebellar abscess may be produced by involvement of the vestibular nerve in the internal meatus.

A sudden diminution of hearing power on the sound side is rather in favour of meningitis than of cerebral abscess, although this symptom is also observed in rare cases of cerebral abscess. Marked rigidity of the neck favours the assumption of meningitis. Hyperæsthesia of the cutaneous coverings is also a meningitic symptom. If the meningitis involves the convexities the differential diagnosis is usually more easy. General convulsions appear, with navicular depression of the abdomen, a small accelerated pulse, the Cheyne-Stokes phenomenon, and total loss of consciousness.

In meningitis serosa the symptoms of diffuse meningitis are also present, although those of cerebral pressure predominate, and the pyrexia is only slight. The same may be said of tuberculous meningitis. Sinus thrombosis also, and certainly that of the transverse and cavernous sinuses, simple middle-ear suppuration and that complicated by mastoiditis, may be accompanied by severe cerebral symptoms. Should these processes be associated with

facial paralysis, nystagmus, vertigo, vomiting, headache, choked discs, optic neuritis, somnolence and convulsions, the differential diagnosis from cerebral abscess becomes almost impossible. As a rule, such symptoms occur with uncomplicated otitis media only in the earliest childhood. In hysteria, otitis media not infrequently occurs simultaneously with hemianæsthesia, hemiparesis, vertigo, vomiting, and visual disturbances. In hysteria, however, the spasmodic paralyses and the anæsthesia are present on the affected side instead of being crossed (von Beck, *loc. cit.*). The latent stage of cerebellar abscess may also be confounded with melancholia or the depression stage of general paralysis, the depression and vomiting associated with pregnancy, and operation therefore not undertaken (Koch, "Der Otitische Kleinhirnabszess," 1897). Uræmia also, owing to the presence of headache, optic neuritis and vomiting, and severe infections, may exhibit a similar clinical picture to that of cerebral abscess.

IX

PROGNOSIS

THE proportion of cures, according to Körner's statistics, is considerably greater than that which is seen in my collection. In 55 cases of cerebellar abscess operated upon, the cures amount to 52 per cent. The want of any general statistics is a defect in relation to Körner's statistics, as a greater number of cured than of uncured cases form the subjects of individual communications. According to Koch, out of 19 cerebellar abscesses operated upon, 10 were cured; according to Okada, 16

cases of cerebellar abscess were cured out of 25 operated upon.

Of 645 cases reported by Heimann (196 cerebellar abscess), the abscess was evacuated in 519 cases. Of the 193 cases in which cure resulted, the site of the abscess was as follows :

	Cases.
In the temporal lobe	144
In the cerebellum	40
In the occipital lobe	3
In the hemisphere	3
In the temporal lobe and cerebellum	3
Total	193

My collection shows the following proportions :

NEUMANN, 1900—1905.

196 Cases of Cerebellar Abscess.	Number of Cases.	Percentage.
1. Cases cured by operation	40	25'98
2. Unsuccessful operation, but spontaneous healing	1	0'15
3. Death in spite of evacuation of the abscess	31	20'13
4. Suppurating cavity not reached by operation	18	11'69
5. Operation refused	1	0'15
6. Diagnosis impossible owing to latent course	10	6'59
7. Unable to make diagnosis owing to other endocranial complications	34	22'06
8. Patient came too late for treatment ...	6	3'90
9. Paralysis of respiration	10	6'50
10. Operation had to be interrupted	2	1'14
Cases	153	99'50
11. Inadequate description	43	
Total	196	

The results of investigation at our clinic in the main accord fairly well with the above proportion of cured cases. Out of 28 cases there are 7 cures,

which is equivalent to a co-efficient of cures of 25 per cent.

The following tabular summary furnishes information as to the causes of death :

Causes of Death.						Cases.
1.	Two or more abscesses in the cerebellum	...	...	...	...	12
2.	Abscesses in the cerebrum and cerebellum	...	...	...	...	5
3.	Encephalitis and encephalo-meningitis ...	...	...	...	...	3
4.	Purulent lepto-meningitis ...	...	...	...	...	34
5.	Sinus phlebitis and pyæmia	...	...	...	...	13
6.	Meningitis and sinus phlebitis	...	...	...	...	10
7.	Toxic coma ...	...	...	...	...	2
8.	Pneumonia ...	...	...	...	...	1
9.	Paralysis of respiration	...	...	...	...	10
Total						90

It appears from the preceding table that 51·5 per cent. of the deaths are due to meningitis. The comparatively high percentage of multiple cerebellar abscesses (9·4 per cent.), and the combination of cerebellar with cerebral abscess (5·97 per cent.), is noteworthy. It should, however, be remembered that, as regards circumscribed multiple abscesses, one is not infrequently dealing with more or less extensive diverticula of a single abscess, which communicate with the latter merely through a small aperture.

Although, as is apparent from the above statements, the mortality from cerebellar abscess is still invariably a high one, yet in more recent times, thanks to the increased knowledge in the regions of pathogenesis and diagnosis, progressively more favourable results are obtained, and a further increase in the percentage of cures is also to be anticipated in the future.

In general the prognosis depends upon the nature of the complication present, and, further, upon the size of the abscess and the conditions as regards drainage.

Rapid improvement in the cerebral symptoms is naturally a favourable sign in this connection, although it must not be forgotten that every time the pressure is relieved—as, for example, by evacuation of the cranial contents—a subjective and objective improvement is observed for one or two days. As a general rule, unless one is dealing with cases in which the anatomical conditions are very favourable—that is to say, superficial small abscesses with good possibilities for drainage—a good prognosis should not be given too early.

X

OPERATION ON CEREBELLAR ABSCESS

THE methods recommended for the evacuation of cerebellar abscess may be grouped in two primary forms. A series of writers advise operation on the abscess from the skull, though the great majority of operators open it from the middle ear.

The various methods of trephination differ only as regards the point of attack. The operation is performed by the first-mentioned procedure by von Bergmann (older method), Chauvel, Macewen, Jourdanet, Schlange, Dean, Hulke, Barker, and Ballance.

Simple opening of the abscess from the skull, which was formerly the procedure most frequently employed, has in the course of time become almost obsolete. This is due to the fact that on the one hand the abscess is difficult to find, and on the other hand that the primary focus of suppuration is not extirpated.

Jansen (Bergmann's more recent method), Koch, Trautmann, and Brieger, as well as most modern aural surgeons, operate from the middle ear.

Von Bergmann commences the operation for evacuation of cerebellar abscess by chiselling away the mastoid process until the posterior cranial fossa is reached. This procedure is analogous to that employed in searching for perisinuous foci of suppuration in general. In this way the corpora geniculata and the descending peduncle of the transverse sinus are exposed. If no definite path of conduction to the cerebellum is found in this situation, the angle formed between the horizontal and descending peduncles of the sinus is entered, according to Körner's method. Koch (*loc. cit.*) also recommends this mode of operation, and advises that the exploration of the cerebellum should not be undertaken from an incision in the bone situated behind the sinus, but from the operation cavity formed by the removal of the mastoid process. The advantage of this latter procedure is that in the first place a defect in the skull is avoided, whilst on the other hand the discovery of a small abscess in the depth of the medulla, situated near the median line, is rendered more easy than it would be after cutting through a more or less thick layer of cerebral parenchyma. According to von Bergmann, the risk of a lesion of the facialis, acusticus, and sinus, is almost completely excluded by the employment of this method, as sufficient space is allowed between the sinus and the posterior semicircular canal to approach the posterior pyramidal surface. It is unnecessary to make a large incision upon the posterior pyramidal surface, as cerebellar abscess never contains the large shreds of necrotic brain substance which are found in most cases of abscess of the temporal lobe. For this reason Koch (*loc. cit.*) believes that it is quite superfluous to irrigate cerebellar abscess, but that it suffices to introduce a drainage-tube, which is left *in situ* until it becomes dry.

In order to obviate bending of the drainage-tube between the bony margin, and possible prolapse of the brain, drainage-tubes with rigid walls should be used, as symptoms of retention of pus may result from slight kinking of ordinary india-rubber drains. Koch considers the use of Nélaton's catheter very advisable. If, owing to cholesteatoma or very extensive caries, a persistent retro-auricular aperture should remain after the radical operation, and if a prolapse of the brain into the wound cavity occurs after evacuation of a cerebellar abscess from the mastoid process, Koch recommends that the prolapse, as well as the defect in the posterior pyramidal surface, should be covered by a cutaneous flap from the neighbourhood of the ear at as early a date as possible.

Barr (*Z. f. O.*, Bd. 28), in brain abscess, both of the temporal lobe and the cerebellum, advises that a second opening about $\frac{1}{2}$ inch in diameter should be made with the trephine in addition to the one leading to the middle ear, in order that the soft medullary masses of brain, loaded with septic germs, which are usually present in association with such abscesses, in the former case on the lateral wall of the skull above the ear, in the latter behind the sigmoid sinus, may be more easily removed.

Barr is further of opinion than in cases of leptomeningitis due to rupture of a cerebellar abscess cure is possible if the abscess is opened, evacuated, and drained, at a very early stage of the meningitic symptoms.

Jansen (*Verhandl. der Deutschen Otolog. Gesellschaft*, 1895), in those cases in which the diagnosis of the site of the intracranial complication cannot be made previous to operation, recommends that the posterior cranial fossa and the neighbourhood of the sinus should always be

exposed after chiselling away the mastoid process in relation to the radical operation, the sinus itself and the cerebellum being eventually explored.

If, on opening of the mastoid process, the suppuration is found to have extended in a posterior direction, a horizontal incision, from 3 cm. to 5 cm. in length, in the middle of the vertical skin incision, is made through the skin and periosteum in a posterior direction. Then the posterior margin of the bony wound is removed with the chisel and mallet until the antero-lateral wall of the sigmoid sinus appears as a projecting eminence. If the sinus is covered with pus or granulations, it must be exposed until the healthy portion is reached, in so far as this is practicable without injury to the facial or the labyrinth. According to the extent of the extradural abscess, the whole of the inner wall of the mastoid process, in relation to a portion of the floor of the posterior cranial fossa, is removed. Körner (*loc. cit.*), in order to avoid concussion of the skull, employs bone-cutting forceps and the rotating circular saw, using the chisel only when the first-mentioned instruments cannot be employed. When removing the inner wall of the mastoid process, the nearness of the labyrinth should always be borne in mind, as injury of it may lead to a purulent labyrinthitis. If the sinus is intact, the posterior cranial fossa should be exposed to such an extent that the sinus and dura can be lifted by an elevator from the posterior pyramidal wall. If in this situation also no pus is found, and the clinical symptoms are in favour of a focus in the posterior cranial fossa, Jansen exposes the upper corpus geniculatum of the transverse sinus and the adjacent portion of its superior horizontal course, because in some cases suppuration is discovered in this region, having extended to the transverse sinus

from the median cranial fossa along the superior petrosal sinus.

Okada (*loc. cit.*) does not consider that the same mode of operation is applicable to all cases. He selects the route through the median wall of the antrum if the cerebellar abscess is sought for in direct relation to the radical operation—if the diagnosis of cerebellar abscess is certain or highly probable, and if the anatomical conditions of the mastoid process are favourable. On the contrary, he opens the cranial cavity from outside in all those cases in which the radical operation had been previously performed, or the anatomical conditions of the mastoid process were very unfavourable, as, for instance, where there was a prominent projection of the sigmoid sinus. In cases of deep-seated cerebellar abscess due to labyrinthine conditions, according to Trautmann (*"Leitfaden für Operationen am Gehörorgan,"* 1901), the posterior wall of the pyramid should be chiselled away from the median margin of the sigmoid sinus to the external semicircular canal; at the apex of the triangular portion removed one comes to the aquæductus vestibuli, and reaches the abscess most easily.

Krause (*Beitr. zur Klin. Chir.*, Bd. 37), in a case of labyrinthine suppuration with deep extradural abscess, in which the symptoms allowed of the assumption of temporal lobe or cerebellar abscess, first exposed the median cranial fossa from the skull, and on finding no pus in this situation lifted the dural sac with a dural spatula, and in this way discovered the abscess on the posterior pyramidal surface. Finally, Jansen removed the pyramid as far as the shell of the labyrinth, and thus rendered an abscess accessible.

These varieties in the operation cannot pretend to be

separate methods, as the median and posterior cranial fossæ may be exposed from the middle ear in much more simple and less dangerous ways.

For the exposure of the posterior cranial fossa, Krause (*loc. cit.*) advises the following procedure: A cutaneo-periosto-osseous flap is cut of a sufficient size to expose completely the cerebellar hemispheres. On the right side the incision passes near to the external occipital crest, and parallel to it, then makes a right-angled curve around the superincurved line, and passes on the median margin of the mastoid process down to its apex. After cutting through the skin and periosteum, two Doyen's drill perforations are placed at both extremities of the superior horizontal section, the dura loosened by Braatz's elastic probe, and the bone corresponding to the skin incisions separated throughout by Dahlgreen's forceps. Finally this cutaneo-periosto-osseous flap is turned down. The dura of the cerebellum is now exposed; above is the transverse, and on the right the sigmoid sinus. The dura is incised close to these two sinuses and parallel to them, thus corresponding to the median longitudinal section, so that a somewhat right-angled dural flap, with the base downwards, may be turned down.

This method of operation, however, should be considered only in regard to aseptic operations in the posterior cranial fossa. It may especially be employed for exposure and resection of the acusticus in given cases.

With reference to operation upon deep extradural abscesses of labyrinthine origin, and cerebellar abscesses resulting from them, Jansen (*A. f. O.*, Bd. 35) advises that the median wall of the antrum should be carefully explored, and special attention devoted to any fistulæ found there. Even when fistulous tracts are absent on

the median wall of the antrum, they are found without difficulty on opening the posterior cranial fossa, if the aperture is considerably extended in a lateral direction. If, however, the extradural abscess has not extended sufficiently in a lateral direction, the greatest difficulty may be encountered in the discovery of the fistulous tracts. That of fistulæ of the posterior cranial fossa is rendered still more difficult if the sinus is very prominent, and the bony furrows of the sigmoid sulcus have sharply prominent margins. The point of insertion of the aquæductus vestibuli also limits the view. According to Jansen (*Verhandl. der Deutsch. Otol.*, 1895), in such a case one may palpate the superior pyramidal margins from the exposed median cranial fossa by means of a correspondingly curved probe, and expose the abscess, whilst the superior pyramidal margins are removed, together with the anterior and posterior surfaces of the petrous bone. As, however, the vestibular suppuration persists after evacuation of the abscess, and a purulent meningitis may be set up by extension of the suppuration by way of the acusticus, Jansen recommends that the vestibule should be opened after exposure of the abscess. With a small chisel the posterior half of the superior vertical and posterior semicircular canal, respectively, are chiselled away from behind upwards, and the vestibule exposed from below backwards by removal of the posterior half of the horizontal semicircular canal. This method of operation is indicated in labyrinthine cerebellar abscess as a preliminary procedure before the incision of the abscess from the anterior surface of the cerebellum.

Brieger (*Verhandl. der Deutsch. Gesell.*, 1905) is strongly in favour of approaching the abscess from the exposed middle-car space. In doubtful cases, however, the con-

sideration arises that the meninges may be easily infected through the free communication with the suppurative focus. In order to avoid infection, Brieger performed temporary resection of the scalp in one case, and from thence explored the brain substance, this procedure being undertaken some time after exposure of the dura of the median cranial fossa.

We chiefly advocate that in every case of assumed or positively diagnosed cerebellar abscess the cavity of the middle ear should, in the first place, be thoroughly chiselled out. We deviate from this rule only in exceptional cases, in which evacuation of the abscess at the earliest possible moment is indicated, owing to dangerous symptoms of general and cerebral pressure. In these cases we trephine immediately upon the suppurating focus in the brain.

The advances which have been made in the treatment of endocranial complications of otitic processes are dependent chiefly upon the following factors :

In the first place, we do not delay the performance of the operation to the time when all the symptoms of the abscess are fully developed, because experience shows that the prognosis of operative interference is most favourable in the early stages. In the second place, however, we depart from our general rule when it is necessary to first attack the primary focus of disease in the temporal bone, and to follow the process from thence to the dura and the brain.

The establishment of the genesis of the cerebellar abscess is of fundamental importance as regards the selection of the mode of operation. If functional testing previous to operation indicates the presence of labyrinthine suppuration, the radical operation is combined

with opening of the labyrinth, in order that the abscess may be discovered.

This procedure not only presents considerable technical advantages as regards complete evacuation and effectual drainage of the abscess, but in doubtful cases its results may be of great diagnostic importance. Experience shows that labyrinthine cerebellar abscess and purulent labyrinthine disease often manifest similar clinical characteristics, so that the decision as to whether a cerebellar abscess is associated with the purulent disease of the labyrinth, which is shown to be present by the results of the functional testing, often presents the greatest difficulty. In these cases we first perform the labyrinthine operation, and then await its results. If the clinical symptoms still persist after operative opening of the labyrinth, the diagnosis of cerebellar abscess is confirmed.

As an illustration of this method of operation I may quote the following case.

KAROLA, J., 4½ years old. Admitted August 24, 1906.

The mother of the patient was stated to have had pulmonary disease. At the age of eighteen months fever occurred, and fourteen days later conjunctivitis lymphatica. Two years before admission the child suffered from suppuration of the left cervical glands. About a year ago left otorrhœa appeared, its onset being unaccompanied by pain, and the discharge always offensive. It was sometimes abundant, sometimes scanty. A few weeks ago the discharge completely dried up. Four days before admission there was pain in the left ear and moderate fever, two days later associated with headache, vertigo, vomiting and severe retching, exhaustion and loss of appetite. The patient was admitted to the clinic on account of the increasing severity of the pathological symptoms.

Present State.—Well-developed child, fairly well nourished, with pale skin and anæmic mucous membrane. Noisy inspiration and delayed sharp expiration over the left pulmonary apex. Internal organs normal. Senses slightly

dulled. There is general hyperæsthesia, and the power of perception is markedly diminished. The pupils are of medium size, and react sluggishly to light. The movements of the head from before downwards are limited. Cervical vertebræ very painful on pressure. Temperature 37.6° ; pulse 92, and of medium strength.

Right Ear.—Tympanic membrane retracted; somewhat dull and opaque.

Left Ear.—Exceedingly fœtid thick secretion in the meatus. Abundant discharge of cholesteatomatous masses on irrigation. There is a large perforation in the tympanic membrane, including both posterior quadrants. Remainder of tympanic membrane opaque and reddened. Wall of promontory granulating and covered by cholesteatoma.

3. p.m.: Temperature 37.5° ; pulse 92.

7. p.m.: *Status idem.* Temperature 37.3° ; pulse 96.

No restlessness. Comfortable sleep.

Diagnosis.—Chronic suppurative otitis media; labyrinthitis; deep extradural abscess; cholesteatoma.

August 24, 1906: Operation in evening (Dr. Neumann). Typical skin incision; exposure and opening of mastoid process. Gush of fœtid pus at the first stroke of the chisel. The mastoid process infiltrated with pus, which from the surface reached to the antrum. Antrum, hypo- and epi-tympanic cavity, filled by cholesteatoma. The abscess extended posteriorly as far as the sinus, the lateral wall of which was exposed in a length of 2.5 cm. The wall of the sinus was thickened and covered by granulations; the sinus contained blood. The abscess extended in a median direction along the posterior cranial fossa, between the latter and the posterior pyramidal margin.

Exposure of the dura of the median and posterior cranial fossa; opening of the horizontal semicircular canal. Performance of Neumann's operation on the labyrinth (excision of posterior pyramidal wall). Dura of posterior cranial fossa thickened. Vestibule opened from the promontory. No escape of fluid. Neumann's plastic operation. Wound dressed.

Lumbar puncture. Evacuation of clear fluid on moderate pressure.

Post-Operation.—Spontaneous nystagmus as before.

FUNCTIONAL TESTS.

Air.	Bone.	R.	L.	Air.	Bone.
		After Pol.	Before Pol.	Before Pol.	After Pol.
		Width of Room } Voice 4 m. 1.8 m. Whisper percep. Acoumeter.			
		Weber not localized.			
		Slightly shortened. Schwabach. Much shortened.			
		Gellé not proved.			
		+ C ₁ —			
		+ C ₄ + if struck hard.			
		Galton not taken.			
		Watch : Bone absent.			
		Acoumeter : Bone absent.			

Marked greatest excursion to sound side.	}	Spontaneous Nystagmus	{	Very slight towards affected side.
		Caloric Nystagmus	...	{
				With cold water, no marked movement. With warm water, no movement.
		Galvanic Nystagmus	...	Not tested.
		Rotatory Nystagmus	...	Not tested.
		Equilibrium	...	{
				Standing with open eyes : Swaying.
				Walking with closed eyes : Marked staggering to right, soon to left.



August 25: Restless sleep. Moderate amount of headache. Some stupor. Severe spontaneous nystagmus towards the sound side, and very slight nystagmus towards the affected side. Temperature 38.5° .

August 26: Headache and stupor somewhat diminished. Spontaneous nystagmus towards the sound side less severe; no nystagmus towards the affected side.

Dressings changed. No secretion; no escape of fluid.

August 27: Disturbed sleep. Headache and slight stupor. Movements of the head limited. Nystagmus as before.

August 28: No headache. Patient talks with animation to his relatives. The movements of the head are still limited.

Dressings changed. Non-fœtid pus in the tympanic cavity; fœtid pus in the retrolabyrinthine wound cavity.

August 29: Headache. Severe stupor. Movements of head limited. Spontaneous nystagmus both towards the normal and the affected side, even more severe than before the operation. No ataxia of upper extremities (lower extremities not tested).

August 30: Moderate headache. Stupor less. Spontaneous nystagmus less severe towards both sides. Dressings changed. Slight suppuration in retrolabyrinthine wound cavity.

August 31: Good subjective condition. No nystagmus.

September 1: *Status idem*.

September 2: Patient feels quite well; talks animatedly to his relatives. Slight nystagmus towards the normal side.

September 5: At the urgent wish of the relatives the patient was dismissed for ambulatory after-treatment, in spite of strong representations as to the inadvisability of this step.

September 6: During the night of September 5-6, the patient suffered from intense headache, with sleeplessness, and he was therefore again received into the clinic. On examination nystagmus was found to be present towards the affected side.

Operation (Dr. Neumann).—Incision of the dura of the posterior cranial fossa in the depth of the vestibule. Evacuation of a fair amount of fœtid pus. The brain knife was then introduced, resulting in the immediate escape of hissing and stinking pus. After enlargement of the incision, about three tablespoonfuls of pus were evacuated. The incision of the dura towards the sinus was also enlarged

Dressing. Immediately after the operation nystagmus towards both sides was observed; $\searrow$ right $>$ $\searrow$ left. The child was free from pain, cheerful, and has slept quietly.

September 7: Feels well. Right nystagmus. No nystagmus towards the left.

Dressing changed. Escape of about half a tea-spoonful of yellowish-green non-fœtid pus from the brain abscess wound.

September 8: Dressing changed. Escape of a few drops of pus mixed with particles of brain substance from the cerebral wound.

September 9: Dressing changed. A few drops of non-fœtid pus. Small prolapse of brain. A little purulent secretion in the tympanic cavity.

September 10: Nystagmus $\searrow$ right; $>$ $\searrow$ left.

September 25: Dismissed for ambulatory after-treatment.

October 16: Complete epidermization of operation wound.

The symptoms appearing six days previously might be traced to an acute exacerbation of the chronic process. The result of functional testing of the labyrinth, together with the general condition, warranted the assumption of deep extradural abscess and suppuration of the labyrinth. Although no fistula was discovered at the radical operation, the presence of the deep extradural abscess induced us to open the labyrinth. For a short time after the operation the nystagmus remained unaffected; that towards the affected side disappeared completely, to recur with increased severity about five days after the operation. At the urgent desire of the parents we allowed the child to leave the clinic, though with the explicit statement that complications might still be anticipated. On the following day the child suffered from intense headache, and was therefore readmitted. Puncture of the posterior cranial fossa was immediately performed, and showed the presence of cerebellar abscess. By this time it was clear that the post-operative nystagmus towards the affected side was of cerebellar origin. Consequently in this case

the diagnosis of cerebellar abscess was confirmed by preliminary removal of the labyrinth.

In order to render the motives more clear which induced me to undertake the labyrinthine operation in the case under consideration, I may here briefly mention the leading points in reference to the indications for the opening of the labyrinth. The chart which I have drawn up, and which was adopted at Politzer's clinic some years ago, is as follows:*

	Cochlea.	Excitability of Vestibular Apparatus.	Fistula.	Spontaneous Nystagmus.	Operation.
I.	+	+	+	{ + -	None. None.
II.	-	+	+	{ + -	If necessary. None.
III.	+	-	+	{ + -	Operation. If necessary.
IV.	+	-	-	{ + -	" "
V.	-	-	+	{ + -	Operation. "
VI.	-	-	-	{ + -	" "
VII.	-	+	-	{ + -	None. None.

Thus the preceding case belongs to Group IV. The presence of spontaneous nystagmus towards the sound side gave only a conditional indication for the opening of the labyrinth. As, however, a deep extradural abscess was discovered at the operation, and the results of functional testing of the cochlear and vestibular apparatus indicated that its site of origin was in the labyrinth, an absolute indication was afforded for the operative opening of the labyrinth.

If the functional testing of the labyrinth affords no grounds for the assumption of the existence of labyrinthine

* "Indikationen für die Operative Eröffnung des Labyrinthes," by Dr. Heinrich Neumann (Verh. d. Deutsch. Otol. Ges.), 1906.

suppuration, we perform as a rule the ordinary middle-ear operation. By this procedure we endeavour to extirpate the primary pathological focus and to avoid possible re-infection. We adhere to the principle of completely chiselling out the middle-ear space, even in acute cases. In rare exceptions only, where narcosis or the vibration of the procedure may be dangerous owing to the condition of the patient, or the size or situation of the abscess, the more rapid and conservative proceeding of simple opening of the mastoid process should precede the radical operation.

As a general rule, simple opening of the mastoid process is only indicated when the middle-ear process has already died away or the patient hears only with the ear to be operated upon.

In all cases it is better to chisel away the posterior wall of the meatus, in order to permit thorough examination of the region of the tegmen tympani and antri. In certain cases the roof of the tympanic cavity and of the antrum may be removed, so that an easy exit may be furnished for the pus, cholesteatoma, etc., accumulated in these cavities.

Subsequently the dura of the posterior cranial fossa is exposed, and it and the sinus carefully examined. The presence or absence of cerebral pulsation affords no information as to the existence or not of an abscess. This applies especially to the sigmoid sinus, the pulsation of which is transmitted from the cerebellum. It is well known that cerebral pulsation may be abolished in all processes associated with increase of intracranial pressure. If the dura is normal and the cerebral symptoms vague and doubtful, and there are no characteristic focal symptoms, but only general symptoms of increase of

cerebral pressure, such as slowing of the pulse, headache, diminished cerebral activity, the indications point in the first place to awaiting the results of the operation already performed before proceeding to further opening of the cranial cavity. Cases are observed in which the most severe endocranial symptoms promptly retrogress after elimination of the primary infective focus, notably in childhood and at puberty.

On the other hand, however, it should be remembered that each delay of the operation materially diminishes its chances of success, and on account of this the exposure of the dura at the first operation should be sufficiently extensive to allow of exact and extensive exploration.

The exposed dura has a tendency to form adhesions with the adjacent soft meninges. If in the further course of the disease the necessity of incising the dura arises, incision and exploration of the brain are materially facilitated, as in the first place narcosis is unnecessary, and, secondly, a diffusion of pus into the intermeningeal spaces can scarcely occur, owing to the formation of adhesions.

As regards diagnostic puncture of the brain, in many cases it is necessary to perform this repeatedly before one discovers the abscess. In this connection it should be pointed out that puncture of the brain through the dura is not permissible if the latter is completely intact. Punctures through a pathologically thickened dura, infiltrated by granulations, are also dangerous even after careful external disinfection, because infective germs from the deep dural layers are easily inoculated by the needle in the deep tissues, and may produce intermeningeal hæmorrhages (Zaufall, *loc. cit.*). According to Kümmer (Verhandl. der Deutsch. Otol. Ges., 1895), repeated

punctures placed close to one another result in hæmorrhagic softenings, which under certain circumstances may form a *locus minoris resistentiæ* for the reception of pathogenic germs. I have had the opportunity of observing two such cases.

Puncture of the brain without preliminary incision of the dura requires much consideration. Exclusive of the fact that, on the withdrawal of the hollow needle, pus may penetrate into the intermeningeal spaces and induce purulent meningitis, severe inter- and intrameningeal hæmorrhages may result from injury of the bloodvessels. If the pus of the abscess is thick or mingled with shreds of necrotic brain substance, puncture may give a negative result in spite of the presence of an abscess. On the other hand, however, the puncture needle may not penetrate the abscess membrane, if the latter is of considerable thickness and firm consistency. It is, therefore, in all cases more advisable to incise the dura in the first place, and subsequently to incise the brain with the knife (von Bergmann).

In order to enlarge the wound in the brain and to facilitate as complete an evacuation of the abscess as possible, the dressing forceps are employed or the finger introduced. Digital exploration, contrary to the opinion of many writers, has no worse results. It is understood that this manipulation must be carried out with the most scrupulous care, so as not to injure the delicate cerebral layer which separates the abscess from the meninges and the ventricles.

As regards exploration of the cerebellum, I introduce a pair of dressing forceps in a posterior and downward direction.

If the sigmoid sinus is thrombosed, it is advisable to

incise it and evacuate its contents. If it is necessary to examine the postero-external portion of the cerebellum, a cutaneo-periosto-osseous flap is formed, with its base downwards, and trephination performed. It is to be noted that the emissary mastoid vein or the transverse sinus are not to be entered.

If the abscess is found, it should be freely opened, so as to allow of free escape of the pus and necrotic shreds of tissue. In the presence of large abscess cavities, the formation of a counter-opening behind the sinus is invariably indicated, especially in those cases of large cerebellar abscesses where one does not wish either to ligature or cut through the sinus. This method allows of the effectual irrigation of the abscess cavity by aseptic fluid. Under certain circumstances the walls of the abscess may be cleansed by means of a sharp spoon from the shreds of necrotic tissue which adhere to them. As many abscesses are deficient in membrane, and have many deficiencies and recesses in their walls, inspection should be completed by digital exploration. After evacuation of the abscess, a thick drainage-tube, wrapped in iodoform gauze, is placed in the abscess cavity. As a general rule, too little stress is laid upon the addition of the iodoform gauze, though its importance should not be undervalued in relation to the course of healing. The drainage-tube works as a sieve, which strains off the larger particles, whilst the rest is allowed to escape unhindered (Körner, Uchermann). If the iodoform gauze is omitted, the drainage-tube becomes obstructed by necrotic masses, and in this way symptoms of retention of pus, such as headache, rise of temperature, etc., are again produced. In cases where the abscess extends far backwards in a median direction from the sinus, it is advisable that the

drainage-tube should be inserted through the plastically widened meatus, in order to prevent its being kinked.

If the cerebral abscess focus is discovered in the area of the exposed portion of the dura, the brain substance projects in the form of a prolapse through the incision in the dura, this being due to the fact that the cerebral layer around the abscess has experienced encephalitic changes. The increase of cerebral pressure pushes the masses of brain which have been softened by encephalitis through the incision. This renders it possible to incise the brain substance still in the open field of operation, and thus avoid infection of the meninges and intermeningeal hæmorrhage.

XI

AFTER-TREATMENT

As regards after-treatment, absolute rest in bed is of primary importance, and should be persisted with until complete cure has occurred. It is highly essential to avoid everything which may predispose to fluxion hyperæmia of the brain. Nutrition and the intestinal functions must be so regulated that excessive demands on the organism, due to abdominal pressure and vomiting, are avoided. The frequency with which the dressings are changed is dependent upon the peculiarities of individual cases. If the primary focus of suppuration is entirely eliminated and the abscess cavity completely evacuated, the cerebral wound may in some cases heal under the first dressing. The only case found in the literature of the subject in which this is stated to have occurred is one reported by Macewen. In the majority of cases daily

dressing is advisable so long as secretion is present in the abscess cavity. I have even been obliged to renew dressing twice daily. The condition of the temperature and pulse, as well as that of the symptoms existing before the operation, should be carefully observed, and the dressing changed if there is the slightest indication of a change for the worse. A recrudescence of the cerebral symptoms present before the operation, such as headache and fever, points to retention of secretion in the crypts and angles of the abscess cavity, and indicates immediate thorough cleansing and renewed exploration of it. If optic neuritis occurs during the healing of the wound, this symptom not having been observed before the operation, it is in many instances not dependent upon intracranial processes, but upon compression due to the dressing. On loosening the latter, rapid retrogression of the retinal symptoms is often seen. According to many writers, the occurrence of prolapse of the brain points to the existence of a second unopened abscess. Since, however, it is also met with in cases where incision of the prolapse has a negative result, the formation of the latter ought to be ascribed to increase of intracranial pressure due to serous meningitis, or to a progressive encephalitis.

The prolapse is larger in proportion to the greater thickness of the cerebral layer which covers the abscess cavity. If the prolapse attains no considerable size, it may under certain circumstances disappear spontaneously after retrogression of the encephalitic process. Otherwise it is advisable to excise with a knife the prolapsed portion of brain at the level of the dural wound, and to sprinkle iodoform powder over the surface of the wound. In some cases, in spite of all the means employed, the operation wound shows no tendency to heal. This is especially seen

in association with anaërobic non-membranous abscesses with numerous recesses, in which retention of secretion occurs in spite of abundant drainage. In my experience, the employment of peroxide of hydrogen has been extremely beneficial in these cases. If the condition of the wound in the middle ear is favourable, it may be closed by an osteoplastic or heteroplastic procedure, by mobilization of a cutaneo-periosteal flap; or, finally, if the defect in the bone is of inconsiderable extent, by secondary sutures.

XII

DETAILS OF CASES

I. ALT (*M. f. O.*, 1904). Man aged 70.

Left Acute Otitis Media.—Mastoid process susceptible on pressure. Exit of pulsating pus from tympanic cavity. Headache. Staggering gait. Vertigo. Inability to stand. Horizontal nystagmus. No fever. No slowing of pulse. Exaggeration of reflexes. Fundus oculi normal. Operation. Cure.

Operation.—Cortex intact. Carious bone and pus at a depth of $\frac{1}{2}$ cm. A fistula, from which pus exudes on the insertion of a probe, leads in a median direction from the lateral sinus into the deep tissues. Opening of antrum, which contained pus and granulations. The fistula leads to the cerebellum. Bone removed in a median direction from the sigmoid sinus; fistula in discoloured dura. Crucial incision and excision of infiltrated portion of dura. Exposure and incision of cerebellum. Evacuation of a nut-sized abscess.

2. ALT (*M. f. O.*, 1904). Man aged 41.

Left Chronic Otorrhœa.—Severe pain in head and left ear. Temperature 38.3° – 39° . Pulse 60. Cholesteatoma in meatus. Bilateral optic neuritis. Operation. Cure.

Operation.—Fistula leading to antrum on planum mastoideus. Escape of fœtid pus on opening the bone itself. Three sequestra in posterior and superior wall of meatus. Cholesteatoma in antrum, middle ear, and meatus. Necrosis of median pyramidal wall in neighbourhood of sinus, and of anterior portion of cerebellum. In the discoloured dura, which is infiltrated with pus, there is a bean-sized fistula leading into a cerebellar abscess. Evacuation. Pause's plastic operation.

3. ANGUS (*Brit. Med. Journ.*, 1903). Boy aged 9.

Sinus thrombosis developed in a boy after opening of a cerebellar abscess, and it was necessary to remove the internal jugular from the clavicle to the mastoid process. Cure.

4. ANDREW J. GRANT (*Brit. Med. Journ.*, 1903). Man aged 26.

Left Chronic Otorrhœa.—Occipital pain. Fever.

Post-operation. Headache. Vomiting. Prostration and slowing of pulse—80. Death.

Radical Operation.—Mastoid process and antrum full of fœtid pus. Sigmoid fossa carious. Sinus exposed; fluid blood escaped on incision of sinus. Headache, vomiting, bradycardia (80), and bradypnœa thirty-nine days after the first operation. Temperature normal. No drowsiness. Sudden arrest of respiration under narcosis. The cerebellum was quickly exposed, but puncture of it gave a negative result. Tracheotomy. An hour and two

minutes later respiration returned, but it was again arrested the day after the operation. Artificial respiration. Death.

Post-mortem.—Abscess in left cerebellum. Zone of brain surrounding it encephalitic. The puncture needle reached the abscess, but the pus was inspissated.

5. BACON (*Trans. of Amer. Otol. Soc.*, 1900). Woman aged 32.

Chronic Right Otorrhœa.—Pain in right ear and right side of head. Rigor. Vomiting. Temperature 38.6°. Pulse 81. Meatus filled with pus.

Post-operation.—Paralysis of left abducens and facial. Hemiparesis, hemianæsthesia, homonymous hemianopsia and choked disc on left side.

After second operation: Increase of paralysis; choked discs. Death.

Operation.—Removal of fœtid pus, granulations, and softened bone. As no fistula was present the wound was dressed.

Second Operation.—Re-opening and enlargement of wound. Dura thickened, but not adherent. Small fistula in dura leading into a large temporal lobe abscess. Incision. Dressing.

Post-mortem.—Large abscess cavity in temporal lobe. Fœtid dense abscess focus in right cerebellum. The site of origin of the abscess was in the corpus dentatum, which it had destroyed. It extended from thence to the opposite lobe. There was no communication between the two abscess cavities. Ventricle normal.

6. BAKER (*Annals of Otol., Rhinol., and Laryngol.*, 1897). Girl aged 19.

Left Chronic Otorrhœa.—Headache. Speech hesitating. Left optic neuritis. Pulse 84.

Operation.—Opening of the mastoid process gave a negative result. Puncture of temporal lobe negative.

Post-mortem.—Necrosis of the temporal bone from base to porus acusticus internus, a large abscess cavity corresponding to this part. An aperture was found which communicated between the inner wall of the tympanum and the posterior surface of the pars petrosa by way of the Fallopian canal. The entire left cerebellar hemisphere was involved in an abscess, which extended to the right side.

7. BARKER (*Brit. Med. Journ.*, 1902). Girl aged 14.

When lifted on to the operating-table, the patient suddenly ceased to breathe, and died in spite of the evacuation of pus from the cerebellum. The pulse continued to beat for two hours and three minutes after the cessation of respiration. Artificial respiration was performed for two hours.

No post-mortem.

Aural suppuration for three months after scarlet fever. Headache and weakness fourteen days before admission. Vomiting. Extremities rigid. Stiffness of the neck, somnolence, no choked discs.

8. BARR (*Z. f. O.*, Bd. 32). Male aged 17.

Bilateral Chronic Otorrhœa.—Cerebral symptoms for three months.

Operation.—Left radical operation. Exposure of sigmoid sinus and median cranial fossa without encountering pus or abnormal conditions.

Post-mortem.—Carious destruction of labyrinthine wall of tympanic cavity, and of the labyrinth itself. Carious eruption covered by normal dura towards the median

cranial fossa, corresponding to the position of the cochlea. Infection occurred through the internal meatus after total destruction of the lamina cribrosa, and complete separation of the acoustic at this point. Ulceration of the cerebellum in the vicinity of the porus acusticus internus, an abscess extending from here into the cerebellum. Purulent meningitis.

9. BARR (*Z. f. O.*, Bd. 32). Man aged 55.

Right Chronic Otorrhœa.—Initial rigor. Vertigo. Occipital pain. Temperature 36.5° – 37.8° . Pulse delayed. Delirium. Choked discs. Exophthalmos. Coma. Death.

No operation.

Post-mortem.—Large abscess in right cerebellum. Thrombosis of both cavernous sinuses. Caries of median wall of tympanic cavity, of Fallopian canal, and of posterior pyramidal wall, corresponding to region of aquæductus vestibuli and communicating with vestibule. Inflammatory infiltration of nerve in internal meatus. Sigmoid sinus normal. Cerebellar abscess due to infection from middle ear by way of porus acusticus internus, with thrombosis of cavernous sinus. Leptomeningitis.

10. BECK (*Beiträge z. Klin. Chir.*, Bd. 39). Woman aged 27.

Left Chronic Otorrhœa.—Symptoms of retention of pus. Pulse 70. Temperature 37.8° . Apathy. Contraction of left pupil. Retinal hæmorrhage. Paralysis of respiration during operation.

Radical Operation.—Abscess size of hen's egg in right cerebellar hemisphere.

11. BOESCH (*Z. f. O.*, Bd. 50). Man aged 42.

Bilateral Chronic Otitis Media.—Intense pain in right ear. Vertigo. No rigors. No vomiting. Pulse 60. Temperature 37°. No nystagmus. Right facial paresis. Weber L. Deafness of right ear.

Post-operation.—Rigidity of neck. Nausea. Pulse 72. Temperature 38·9°. Exaggeration of reflexes. Papillæ on right side reddened.

After the second operation there were rigors, nausea, diplopia. Right globe tender on pressure. Stupor. Temperature 42°. Pulse 152. Sclerotic jaundiced. Paresis of right abducens. Picking at bedclothes. Pupils unequal. Rigidity of neck. Head in position of torticollis towards the left. Trigeminal neuralgia. Later temperature 36·2°. Death.

Radical Operation.—Mastoid process sclerotic. Granulations in antrum and tympanic cavity. Plastic operation. Dressing.

Second Operation.—Trephination of squamous portion of temporal bone. No alteration in posterior cranial fossa. Sinus normal. Small perforation on anterior pyramidal surface corresponding to tegmen antri; at this spot the dura was adherent and beset by granulations. Puncture of brain negative. Dressing.

Post-mortem.—On the lower side of the right cerebellum there was a dirty focus, leading into an abscess cavity the size of a walnut. This cavity extended on to the left hemisphere. The orifice of the aquæductus cochleæ was discoloured. All sinuses empty. The sigmoid sinus was discoloured at one point. This point corresponded to the lower circumference of the endolymphatic saccus. On the anterior pyramidal surface there was a defect 4 mm. in diameter, corresponding to the tegmen aditus ad antrum.

The orifice of the aquæductus vestibuli was reddened and swollen. The dura in the centre of the aquæductus vestibuli was perforated. Necrotic tissue, firmly attached to the bone, and corresponding to the anterior wall of the saccus endolymphaticus, appeared through the point of perforation. At this spot dura mater and pia mater, together with brain substance, were agglutinated, and the cerebellar abscess was directly contiguous to the ichorous saccus endolymphaticus. The external meatus, as well as the facial canal, from the hiatus to behind the enestra ovalis, carious and opened. In the porus acusticus internus the nervus acusticus and facialis were swollen and reddened.

12. BOJEW (*Revue Hebdomadaire de Laryngologie*, 1898). Male aged 18.

Right Acute Otitis Media.—Nausea, vomiting, pain in occiput, rigors. Complete deafness on right side. Weber towards the right. Death six days after operation, due to arrest of respiration.

Operation.—Perforation at apex of mastoid process, with burrowing abscess in neck.

Post-mortem.—Abscess in right cerebellar hemisphere. Sinus neither exposed during life nor at the autopsy (!).

13. BOTY (*Klin. Med.*, 1905). Girl aged 16.

Left Chronic Otorrhœa.—Severe headache, nausea, attacks of faintness. Stupor, hypothermia. Pulse 60. Mastoid process susceptible to pressure.

Post-operation.—Pulse 84. Nausea. Headache. Hemianopsia.

Cure after second operation.

Operation.—Eburnation of mastoid process; antrum small; granulations and cholesteatoma in tympanic cavity. Tegmen tympani and antri communicate with median cranial fossa. Cerebellar dura covered by granulations. Exposure of sinus and cerebellar recess. Escape of 10 g. of thick foetid pus on puncture of cerebellum. Incision of dura. Opposite incision to allow of free escape of pus. Four punctures of temporal lobe resulted in discharge of some pus. Drainage. Dressing.

Second Operation.—Lengthening of posterior incision; two trephine openings at level of centre and base of second occipital convolution; several punctures negative. Healing.

14. BRAUN (M. M. W., 1900). Man aged 27.

Right Chronic Otitis Media.—Temperature 36.2° . Fluid obtained by lumbar puncture clear and free from bacteria. Death.

Operation.—Von Bergmann's operation. Meninges and sinus intact. Incision of temporal lobe negative. Enlargement of cavity in bone in a posterior direction. Abundant pus on incision of cerebellum.

Post-mortem.—No meningitis. Walnut-sized abscess in right cerebellar hemisphere. Necrosis of bone on posterior pyramidal surface in region of facial nerve.

15. BRAUNSTEIN (A. f. O., Bd. 54). Woman aged 20.

Bilateral Chronic Otorrhœa.—Headache. Vertigo. Rigors with subsequent perspiration. Pupils equal. Prompt reaction to light. No nystagmus. Papillary margins obliterated. Pulse 50-60. Temperature 37.4° . Susceptibility on palpation of right temple.

Post-operation.—Rigidity of neck. Pulse 48.

Second Operation.—Large abscess revealed on trephination of cerebellum. Free from fever.

Subsequently meningitic symptoms. Temperature 38.5° – 40.1° . Rotatory nystagmus.

Operation.—Labyrinthine suppuration, but no path of conduction to intracranial focus.

Autopsy.—Abscess in right cerebellum, with rupture into fourth ventricle (streptococci in the escaping fluid).

16. BRAUNSTEIN (*A. f. O.*, Bd. 54). Male aged 17.

The first diagnosis was ichorous cholesteatoma and epidural abscess, but eventually a diagnosis of cerebral abscess was made. Operation confirmed this diagnosis. The sinus was opened and evacuated.

Post-operation.—Headache. Loss of memory. Slowing of pulse. Vertigo.

Second Operation.—Trephining for cerebellar abscess: negative result. Pyæmia. Death.

Post-mortem.—Cerebellar abscess. Pyæmic metastases. No meningitis.

17. McBRIDE (*Brit. Soc. of Otol.*, 1905).

Young man exhibited intracranial symptoms. McBride was unable to find any antrum at the operation.

Post-mortem.—Abscess in left cerebellum. Abscess in left occipital lobe. Complete absence of left antrum (probably as a result of osteitis condensans).

18. BRIEGER (*10 Versamm. der Deutschen Otol. Gesells.*, 1901).

Case of cerebellar abscess cured by operation, due to purulent otitis media resulting from injury of the ear by a shot.

19. BULL (*Otol. Soc. of Great Britain*, 1905). Boy aged 8.

Acute Otitis Media.—Vomiting. Apathy. Pulse 136. Temperature 100° (Fahrenheit). No optic neuritis. No nystagmus.

Post-operation.—Temperature 41°. Pulse 148.

After the second operation: Temperature 40°–41°. Cure.

Operation.—No pus in mastoid process, though there was some in the neighbourhood of the sinus. Ligature of jugularis. Incision of dura revealed softened brain substance, but no pus. Evacuation of a cerebellar abscess.

20. CHAVASSE AND TOUBERT (*Arch. Intern.*, Bd. 20). Man aged 27.

Left Chronic Otorrhœa.—Facial paralysis. Diminished hearing power in left ear. Weber L. Rinne positive. Aural tinnitus. Vertigo. Staggering gait. Vomiting. No leucocytes obtained on lumbar puncture. Left mydriasis. Deviation of eyes upwards and to the right. Left papillæ obliterated. Adynamia. Emaciation.

Death three hours after operation.

Voice 1 m., whisper 20 cm. Result of hearing tests questionable.

Radical Operation.—Granulations in tympanic cavity. Incision of temporal lobe negative. Dressing.

Post-mortem.—Meninges and brain intact. Abscess size of pigeon's egg in left cerebellar hemisphere. Lateral sinus intact. Petrosal sinus thrombosed. Internal meatus filled with pus. Bone of latter necrotic. Pneumococci and micrococci in pus. Suppurative labyrinthitis and dural fistula leading into abscess, and communicating with internal meatus and aqueduct.

21. CHEVAL (*Soc. Belge d'Otol.*, 1904).

Cured case of cerebellar abscess.

22. CONACHIE AND HARTING (*Journ. Amer. Med. Assoc.*, 1899). Boy aged 12.

Right Chronic Otorrhœa, associated with Typhus.—Nausea, vomiting, vertigo. Sudden coma. Cholesteatoma in meatus and antrum. Pulse 66. Temperature normal. Pupils dilated. Photophobia. Yawning. Stupor. Retraction of head. Death.

Post-mortem.—Abscess in right cerebellum.

23. DELSAUX (*Soc. Belge d'Otol.*, 1904).

Large abscess of almost the entire left half of the cerebellum without external symptoms.

24. DENCH (*Trans. of Otol. Sect. of New York Med. Acad.*). Boy aged 8.

Subacute Otorrhœa.—No fever. Fluctuating tumour on mastoid process.

Post-operation.—Cheyne-Stokes respiration. Death.

Operation.—Chiselling out, with removal of all affected portions of bone.

Post-mortem.—Abscess in right cerebellum. On the external wall of the sinus a small carious spot on the osseous wall. Sinus suppurating. The inner wall of the sinus is connected with the large abscess cavity.

25. MAIERHOFF (*Ibidem*).

A case in which a very large cerebellar abscess existed without the presence of choked discs.

26. DENKER (*Z. f. O.*, Bd. 43, S. 21).

W——. Acute Middle-Ear Suppuration (Influenza), Left.—Apathy. Vomiting. Subnormal temperature.

Pulse 80. Pupils sluggish. Patellar reflex retained. Temperature 35.8° – 36.6° . Diffuse headache. No susceptibility to palpation. Pupils sluggish.

Post-operation.—Temperature 35.8° – 36.8° . Pulse 60–68. Vomiting. Left optic neuritis. Conjugate deviation of the eyes to the right. Pupillary reaction improved. *Later:* Left choked disc. Right optic neuritis. Left hemiparesis. Repeated vomiting. Pulse 80–116. Temperature 36.5° – 39.8° . Pain in neck. Sudden severe pain. Screams; marked meningitic symptoms. Left eyelid much swollen. Death.

Radical Operation.—Cells full of pus and granulations. Foetid granulations in antrum. Bone brittle and soft. As a point in the tegmen tympani was suspected, the tegmen tympani et antri, together with the bone up to the corpus geniculatum of the sinus, were chiselled away. The dura over the tegmen was slightly adherent to the bone, and its colour was not quite normal. The external wall of the posterior cranial fossa, in the angle between the horizontal and descending portion of the bone, was therefore chiselled away. Dura normal; no pulsation. Puncture of cerebellum revealed an abscess the size of a pigeon's egg (non-membranous).

Second Operation.—Excision of walnut-sized prolapse of brain, the new incision revealing a new abscess.

Post-mortem.—Transverse sinus intact. Dura in left posterior cranial fossa adherent. In the left cerebellum there were two other abscesses (one small and one large), in addition to the two already opened. Purulent basal meningitis. Exudation on pons and pituitary region. Phlebitis of cavernous sinus. (Temporal bone not examined.)

27. DE STELLA (*Soc. Belge d'Otol.*, 1903).

Bezold's mastoiditis. Perisinuitis. Extradural abscess on posterior pyramidal surface. Cerebellar abscess. Cure.

28. DE STELLA (*Arch. Intern.*, 1903). Boy aged 9.

Acute Left Influenzal Otitis.—Temperature 40° . Intense pain in left temporal region. Vomiting; uncertain gait. No strabismus. No rigidity of neck.

Diagnosis—Acute mastoiditis, sinus thrombosis, and cerebellar abscess.

Post-operation.—Temperature 40° . Prolapse of gangrenous cerebellum. Vomiting. Rigidity of neck. Strabismus. Convulsions of right extremities. Death.

Radical Operation.—Pus in mastoid process. Wall of sinus beset by granulations. Discoloured blood withdrawn on puncture of sinus. Pus revealed on opening sinus. Thrombus in bulb; severe hæmorrhage after its removal. Granulations on dura. Pus found on crucial incision of dura. Cerebellum apparently intact. Drainage. Dressing. Death.

The writer considered an autopsy superfluous.

29. DOUGLAS (*Brit. Med. Journ.*, 1903). Boy aged 15.

Right Chronic Otorrhœa—Sudden headache. Nausea. Pain behind ear. Stupor. Irritability. Speech hesitating. Pupils dilated and equal. Right optic neuritis. Temperature subnormal. Operation. Cure.

30. EAGLETON (*Trans. of Otol. Sect. of New York Med. Acad.*, 1903). Boy aged 14.

Right Chronic Otorrhœa.—Pain in ear and head following trauma. Vertigo. Vomiting. Somnolence.

Fever. Slight deviation of eyes to right. Definite optic neuritis in right eye; slight in left.

Post-operation.—Increase of optic neuritis. Right nystagmus and hemiplegia. Cure.

Operation.—The cerebellar abscess could not be completely evacuated.

Second Operation.—Complete evacuation of the abscess cavity, which by this time had distinctly increased in size.

31. D'ELOORE (*La Presse Oto-Laryngol. Belge*, 1902). Woman aged 20.

There was an obvious connection between the suppurative focus in the cerebellum and caries of the mastoid process. Nervous disturbances were produced by pachymeningitis on the posterior pyramidal surface. Pulse normal. Temperature subnormal. Headache. Fibrillary tremors of tongue. Reflexes exaggerated. Romberg positive. Paralysis of oculo-motorius.

32. EULENSTEIN (*Z. f. O.*, Bd. 47). Woman aged 47.

Sudden intense pain in left ear and head. Temperature 38.9° . Granulations on floor of meatus. Tympanic membrane absent. Decreased hearing power. Mastoid process and jugularis susceptible on pressure.

Post-operation.—Temperature 36.3° . Later temperature 40° . Sclerotic jaundiced.

Severe icterus after second operation. Delirium. Cure.

Radical Operation.—Fœtid pus in mastoid process. Granulations in antrum and tympanic cavity. Extradural ichorous abscess of posterior cranial fossa in region of transverse sinus. Wall of sinus covered with greasy deposit. Ligature of jugular, which contains red un-

degenerated thrombi. Thrombi which have experienced purulent degeneration are found on opening of sinus.

Second Operation.—Sinus again exposed ; contains softened foetid thrombi. On clearing it out semi-solid masses were removed, which microscopical examination showed to consist of cerebellar substance. Healing.

33. FERRARI (*Arch. Ital. di Otol.*, 1900). Girl aged 18.

Right Chronic Otorrhœa.—Headache. Vomiting. Vertigo. Photophobia. Pain in neck. Apathy. Pulse and respiration delayed. Clonic tremors in lower extremities.

Post-operation.—Temperature 37° . Pulse 90. Respiration slow. Constipation. No vomiting. Intense thirst. Excitement. Amblyopia and paresis of abducens on left side. Subsequently temperature 40° . Vomiting, rigidity of neck, insatiable thirst. Photophobia. Cheyne-Stokes respiration. Senses clear. Somnolence. Temperature 37.5° . Pulse 105. Nausea. Pupils unequal. Paralysis of right facialis and abducens. Loss of pupillary and patellar reflexes. Complete blindness. Scanning speech.

After second operation : Vomiting, singultus, epileptiform attacks, conjugate deviation of both bulbi. Death.

Operation.—Attico-antrotomy and complete exposure of mastoid cavity. Neither tegmen tympani nor transverse sinus exposed. Fistulous tract. Trepanation on the cerebellum and evacuation of abscess.

Second Operation.—Removal of easily bleeding neoplasm from floor of abscess cavity (myelosarcoma). The rapidly growing neoplasm was on two further occasions removed by the galvano-cautery.

Ferrari was of opinion that the neoplasm originated from a previous otitic abscess.

No post-mortem.

34. FLIES (*D. M. W.*, 1903). Male.

Right Chronic Otorrhœa.—Operation on account of rigors and facial paralysis. Death, due to paralysis of respiration, at the first stroke of the chisel.

Post-mortem.—Abscess in lower segment of right cerebellum. Route of induction: Aquæductus vestibuli.

35. FREY (*A. f. O.*, Bd. 58). Male aged 38.

Right Chronic Otorrhœa.—Headache on right side. Diminished hearing power in left ear. Purulent secretion in right ear. Temperature 37.6°. Pulse 84. Pupils normal. Romberg indicated. Fundus oculi not examined.

Post-operation.—Confusion. Apathy. Vertigo. Pupils refractory to light; contracted. Vertigo. Reflexes exaggerated. No rigidity of neck. Pulse 70.

After the second operation: Delayed respiration. Pulse on both sides unequal. Nystagmus. Sugar in urine. Vision limited towards the right. Conjugate deviation to left. Nystagmus to left. Pulse arrhythmical. Facial paresis, right hemiparesis; stammering speech. Pupils do not react. Corneal reflex absent. Cure.

Operation.—Cholesteatoma in antrum, cupolar space, and tympanic cavity. Sinus exposed.

Second Operation.—Exposure of dura of median cranial fossa. Puncture of temporal lobe negative. Cerebellar dura infiltrated and granular. Two tablespoonfuls of fetid pus escaped on excision of cerebellum.

36. GILLOT (*La Presse Oto-Laryngol. Belge*, 1902).
Man aged 23.

No otorrhœa. Process insusceptible to pressure. Occipital pain, giddiness on walking, vertigo, vomiting. Impossibility to walk in a straight direction. Nystagmus on extreme direction of vision. Temperature 36° – 37° . Pulse slowed.

Diagnosis.—Gumma cerebelli (?).

Antisymphilitic treatment. Death fourteen days later.

No operation.

Post-mortem.—A nut-sized abscess, with a smaller one near it, in right cerebellar hemisphere. Small carious focus on right petrous bone. Right mastoiditis. Also fistula in upper wall of meatus.

37. GREIFT (*Soc. Belge d'Otol.*, 1904).

Case of healed cerebellar abscess.

38. GRUENING (*Verhandl. der Amerik. Otolog. Gesell.*, 1903).

Both ears were affected, the left more severely than the right. As slowing of pulse, vomiting, and optic neuritis, appeared, the left ear was cleared out and the left temporal lobe and cerebellar hemisphere punctured, but no abscess was found.

Post-mortem.—Abscess in right cerebellum.

39. GRUNERT AND DALLMANN (*A. f. O.*, Bd. 62).
Woman aged 23.

Two years previously removal of malleus and incus owing to caries of the ossicles on the right side. Six weeks previously vertigo, disturbance of equilibrium. R. whisper; L. absent. Fis₄ much diminished. Occipital

pain. Vomiting. Pupils large. Sluggish reaction to light. Temperature 38.2° . Pulse 85. Pus in right meatus. Fluid from lumbar puncture opaque. Increase of leucocytes. Sacrophytic bacilli.

Post-operation.—Stupor. Temperature 37° . Pulse 68. Respiration 20. Vomiting. Cervical susceptibility. Constipation. Fundus oculi not examined. Vertigo.

After the second operation: Temperature 37.5° – 39.1° . Vertigo unaffected. Healing.

Radical Operation. — Non-purulent fistula in horizontal semicircular canal. Posterior pyramidal surface normal.

Second Operation.—Trepanation upon cerebellum and incision of it negative. Incision of temporal lobe negative. Two days later opening of abscess with thick membrane in temporal lobe. A prolapse of the cerebellum, which had appeared in the meantime, discharged on pressure about two tablespoonfuls of pus.

Encephalitis was probably present.

40. GRUNERT AND ZERONI (*A. f. O.*, Bd. 49). Man aged 49.

Right Chronic Otorrhœa and Cholesteatoma.—Vertigo. Nausea. Severe affection of hearing power.

Post-operation.—Headache. Fever, especially in occiput; vomiting; slowing of pulse; interference with ocular muscles. Death.

Radical Operation.—Cholesteatoma in antrum. Discharge of ichorous pus from tegmen antri. Exposure of dura and sigmoid sinus, the latter being greenish-grey in colour. The probe revealed a fistula in the horizontal semicircular canal.

Second Operation.—Cavity the size of a pea in apex of

mastoid. Antrum filled with dirty granulations. Fistula in labyrinthine cavity at level of promontory.

Post-mortem.—Abscess with abscess membrane in right cerebellum. Extravasation of neighbouring brain substance. Adhesion of dura of posterior pyramidal surface with the upper surface of the cerebellum, corresponding to the orifice of the aquæductus vestibuli. Labyrinth full of granulations and pus.

41. GRUNERT AND DALLMANN (*A. f. O.*, Bd. 62). Woman aged 20.

Right Chronic Otorrhœa.—Headache. Vertigo. Rigors. Strabismus divergens. No nystagmus. Temperature $39^{\circ}1'$. Pulse 86. Fundus oculi not examined. Rigor, with temperature of $41^{\circ}4'$.

Post-operation.—Pain in forehead. Myosis. Papillæ obliterated. Lumbar puncture: leucocytes, meningococci. Patient soporific. Choked discs. Paraphasia. Death.

Radical Operation.—Cholesteatoma in aditus and tympanic cavity. Discoloration of wall of sinus. Ligature of jugular. Opening of sinus negative. Dressing.

Post-mortem.—Abscess size of walnut in right cerebellar hemisphere. Circumscribed purulent meningitis of basis. Pus in labyrinth. Purulent infiltration of nerve at porus acusticus internus. Extradural abscess in region of eminentia arcuata. Groove-like necrosis of petrous bone. Defect in tegmen tympani. Peripheral sinus thrombosis.

42. GRUNERT AND DALLMANN (*A. f. O.*, Bd. 62). Boy aged 13.

Left Chronic Otorrhœa.—Headache. Left vertigo. No vomiting. Fundus oculi not observed. Temperature $39^{\circ}9'$.

Pulse 150. Subsequently vomiting; occipital pain. Death.

No operation.

Post-mortem.—Abscess in left cerebellar hemisphere. No meningitis. Left sigmoid sinus full of pus. Caries of mastoid process as far as sigmoid sinus. Labyrinth intact.

43. GRUNERT AND SCHULZE (*A. f. O.*, Bd. 54). Man aged 29.

Left Chronic Otorrhœa.—Swelling behind left ear. Headache; vertigo; no vomiting. Nystagmus towards left. R. whisper; L. Fis_4 , only when struck hard.

Post-operation.—Rigors; fever; perspiration; nystagmus to left. Vomiting; no rigidity of neck; clonic spasms of left lower extremity. Pulse 104. Temperature 38.7° . Diminished hearing power on sound side. Death.

Radical Operation.—Diffuse caries of walls of antrum, which contained cholesteatoma.

Post-mortem.—Dura of posterior pyramidal surface discoloured. Beneath the dura there was a collection of pus, which reached the internal ear by way of the aquæductus vestibuli. A discoloured spot on the posterior surface of the cerebellum led into a walnut-sized abscess cavity. Nerve at porus acusticus normal. Thrombus in sigmoid sinus, which extended to the ventricular jugular bulb.

44. GRUNERT AND SCHULZE (*A. f. O.*, Bd. 54). Girl aged 12.

Right Chronic Otorrhœa.—Cholesteatoma. Headache. Nausea; pain in right ear. Distraction; forgetfulness; vertigo; aural tinnitus. Pupils not noted. No nystagmus. Right facial paralysis. Right papillæ obliterated. Apathy.

Speech hesitating. Temperature 38.9° . Pulse 144. Whisper R. absent. Fis_4 much diminished.

Post-operation.—Temperature 35.9° . Pulse 52.

After the second operation, vertigo; paralysis of right abducens. Meningitis. Death.

Operation.—Inflammatory reddening of sinus wall. A fistula leads from the carious horizontal semicircular canal to an extradural abscess in the posterior cranial fossa. Removal of a portion of the suppurating labyrinth.

Second Operation.—On trepanation of the cerebellum a walnut-sized abscess was discovered.

Post-mortem.—Cerebellar abscess, with rupture into fourth ventricle. Meningitis purulenta.

45. GRUNERT AND SCHULZE (*A. f. O.*). Woman aged 22.

Fœtid suppuration in attic; left aural tinnitus. Increasing difficulty in hearing; headache. Fundus oculi not observed. Left facial paralysis.

Post-operation.—Vertigo. Vomiting. Slowing of pulse.

After the second operation, horizontal nystagmus on looking to the left. Paralysis of left abducens. Nausea. Vomiting. Constipation. Temperature subnormal. Improvement of facial paralysis. Vertigo on getting up. Lumbar puncture opaque; no bacteria. R. whisper; L. ϕ .

First Operation.—Extraction of left malleus and incus.

Second Operation.—Trepanation and evacuation of cerebellar abscess. Pulse frequent after operation. Temperature 38.3° .

On changing the dressing it was seen that a fistula led from the horizontal semicircular canal into the labyrinth, which contained pus.

The posterior pyramidal surface was chiselled away with

the intention of seeking for a deep extradural abscess. No pus was found.

46. GRUNERT AND SCHULZE (*A. f. O.*, Bd 54). Boy aged 8.

Right Chronic Otorrhœa.—Pain in right ear. Headache. High fever. Rigor. No vomiting. No vertigo. Temperature 38·6°. Pulse 136. Pupils equal. Nystagmus. Right papillæ obliterated. Reflexes normal. Fœtid supuration and granulations in tympanic cavity.

Operation.—Cerebellar abscess originating in sinus. Fistula in horizontal semicircular canal.

Post-mortem.—Cerebellar abscess; meningitis.

47. GUARNACERA (*Médecine Moderne*, 1900). Man aged 40.

Left Acute Influenzal Otitis.—Intense pain (left). Left tympanic membrane reddened and perforated. *Left Ear:* Rinne negative; Weber 1. Pulse normal. Temperature 38°. No rigors. No choked discs. No apathy. No nystagmus.

Diagnosis.—Cerebellar abscess. The diagnosis was supported by the disproportion of the slightness of the primary disease and the intense headache.

Operation.—Granulations and pus in antrum. Fœtid pus escaped on incision of cerebellum. Dressing. Cure.

48. GULL (*Guy's Hosp. Reports, Third Series*). Woman aged 20.

Right Chronic Otorrhœa.—Pain in forehead, radiating to occiput and neck, with severe vertigo and retching on rotation of the head. Rigors and perspiration. Facial paralysis. No delirium or loss of consciousness. Pulse small and weak. Discharge of fœtid pus from right ear. Non-fœtid abscess the size of a nut in the right cere-

bellum. The abscess wall was adherent to the dura at one small point, corresponding to the orifice of the aquæductus vestibuli. Tympanic membrane destroyed. Malleus carious. Base of stapes very carious and dislocated. Semicircular canals contain sanguineous fluid.

Path of Induction.—Through the oval window into the labyrinth; by way of the aquæductus vestibuli to the dura and cerebellum.

49. GUTTMANN (*Arch. of Otol.*, 1904). Man aged 20.

Left Chronic Otorrhœa.—Headache. Pupils normal. No rigidity of neck. Optic neuritis. Pulse 60. Jugular region painful. Somnolence. Apathy.

Post-operation.—Pulse 136. Death.

Operation.—Fistula on deep wall of antrum, leading into cerebellum or sinus. Removal of thrombus in jugular and of the facial vein. Fœtid pus obtained on puncture of temporal lobe.

Post-mortem.—Cholesteatoma. Sinus thrombosis. Abscess in cerebrum and cerebellum.

50. HABERMANN (*A. f. O.*, Bd. 58). Man aged 62.

Pain in right ear after influenza. Spontaneous rupture. Subsequent severe otorrhœa. No fever. No rigor. Fundus oculi normal.

Post-operation. — Temperature 37.5° – 39.1° . Pulse 72. Vomiting; vertigo; cervical pain. Fundus oculi not observed. Skull not tender on pressure. Temperature 39.3° . Prostration. Death.

Operation.—Subperiosteal abscess. Antrum full of pus. Exposure of horizontal portion of transverse sinus and of sigmoid sinus. Thrombosis of latter.

Post-mortem.—Cerebellar abscess.

51. HAIKE (*Verhandl. der Berliner Otol. Gesells.*, 1902).

(Short oral report.) There were so few characteristic symptoms that at first the radical operation only was undertaken. When cerebral symptoms indicated involvement of the cerebellum, death occurred before the operation. No fever.

Post-mortem.—Walnut-sized abscess in cerebellum. Purulent disintegrated thrombus in sinus transversus and petrosa superior. Necrosis of pars petrosa behind eminentia arcuata. There was a small carious defect on the posterior surface of the pars petrosa at the margin of the necrotic area, which must be regarded as the route of infection from the ear. It therefore appears that the thrombus originated in the superior petrosal sinus.

52. HAMMOND (*Arch. of Pediatrics*, 1899). Five cases of cerebellar abscess in children.

53. HAUSBERG (*Z. f. O.*, Bd. 44). Girl aged 11.

Acute Left Otitis Media.—On paracentesis watery fluid was obtained. Pain in left temple. Rigidity of neck. Sluggish reaction of pupils. Papillæ hyperæmic, especially left. Temperature 38.2° – 38.5° . Pulse 108.

Post-operation.—Intense headache. Hyperæsthesia of scalp. Pupils dilated; no reaction. Temperature 39° . Pulse 100–150. Death.

Operation.—Collection of pus in mastoid process, extending as far as posterior cranial fossa. Perisinuous abscess. There was no connection with the antrum, owing to which the latter was not opened. The exposed sinus felt doughy. Ligature and incision of sinus, which was full of purulent thrombi. Granulations in corpus geniculatum, which were not touched.

Post-mortem.—Large quantity of pus in left cerebellar hemisphere. No capsule. Dura nowhere adherent. Probably the adhesions of the meninges were ruptured by the chiselling, and purulent meningitis induced.

54. HANSEN (*A. f. O.*, Bd. 53). Woman aged 22.

Right Chronic Otorrhœa.—Vomiting; headache; no fever. Emaciation. Constipation. Right pupil more dilated. Sluggish reaction. Pulse small. Temperature 36·7°. Difference in pupils varying. Death from paralysis of respiration.

Post-mortem.—Walnut-sized abscess in right cerebellar hemisphere. Circumscribed lepto- and pachymeningitis interna. Labyrinth free. Pus only in middle ear.

55. HANSEN (*Ibidem*). Boy aged 14.

Discharge of sanguineo-serous fluid from left ear after trauma. Suppuration three days later. Pain on left side. No vomiting. No rigor. Slight fever; eyes normal. Cure.

Operation.—Chiselling out of antrum and exposure of sinus. Extradural abscess. Sinus thrombosis. Ligature of jugular. Focus of softening in cerebellum.

56. HANSEN (*Ibidem*). Woman aged 20.

Bilateral Chronic Otitis Media.—Headache. Vertigo. Psychological change. Pulse 50. No fever. Right optic neuritis.

Post-operation.—Bilateral choked discs. Death.

Operation.—Opening of abscess in right cerebellum. Labyrinth full of pus, but no path of conduction to abscess.

Post-mortem.—Abscess in right cerebellum, with rupture into fourth ventricle. Purulent basic meningitis.

57. HANSEN (*Ibidem*). Girl aged 12.

Assumed not to be aural trouble. Headache; nausea; vomiting. Then suppuration in right ear. Vertigo. Aural tinnitus; right facial paralysis; right optic neuritis; death.

Operation.—Opening of suppurating labyrinth and cerebellar abscess. Fistula in horizontal semicircular canal. Extradural abscess in posterior cranial fossa.

Post-mortem.—Cerebellar abscess ruptured into fourth ventricle.

58. HANSEN (*Ibidem*). Man aged 29.

Chronic Left Otorrhœa.—Headache; vertigo; no rigor.

Post-operation.—Rigors. Obstruction. Left eye in convergent position. Horizontal nystagmus on looking to left. Apathy. Fundus oculi normal.

Operation.—Diffuse caries of wall of antrum. Only rudiments of ossicles remaining.

Post-mortem.—Abscess in cerebellum.

59. HANSEN (*Ibidem*). Man aged 38.

Chronic Left Otorrhœa.—Vertigo. Headache. Vomiting. Constipation. Pupils normal. No nystagmus. Meatus occluded by granulations.

Post-operation.—Improvement; vomiting; headache. Susceptibility on palpation of left occiput. Difference in pupils. Apathy. Death from paralysis of respiration.

Operation.—Fistula in horizontal semicircular canal filled with cholesteatoma.

Post-mortem.—Cerebellar abscess with dense smooth membrane. Hydrocephalus internus.

60. HANSEN (*Ibidem*). Boy aged 17.

Left Chronic Otorrhœa.—Headache. Vertigo. Falls towards the right and backwards. Left pupil dilated. Sluggish reaction to light.

Post-operation.—Headache. Slowing of pulse.

After the second operation: Rigors; slight left optic neuritis.

Radical Operation.—Opening of cerebellar abscess.

Five days later opening of an occipital abscess.

Post-mortem.—Healed sinus thrombosis. Healed cerebral abscess. Obliteration of the entire left transverse sinus. Metastatic pulmonary abscesses. Pleural empyema.

61. HAYDON (*Brit. Med. Journ.*, 1900). Boy aged 4.

The patient, owing to an operation for abscess in the left cerebellum, suddenly developed headache and vomiting. Somnolence; apathy; hesitating speech; constipation. Pulse 60. Respiration 17. Temperature 36.2°. Pupils equal. Prompt reaction to light and accommodation. Lateral nystagmus. Right patellar reflex weak; left absent. Granulations in meatus. Left facial paralysis. Operation. Healing.

Post-operation.—Slight bilateral optic neuritis.

62. HENNICKE (*M. f. O.*, 1902). Boy aged 8.

Left Chronic Otorrhœa.—Fever. Headache. Somnolence. Mastoid process swollen on both sides. Polypi in both ears.

Post-operation on Left Ear.—Intermittent fever; rigors.

Operation on Right Ear.—No result.

Operation on Left Ear.—Fall of temperature. Rigidity of neck. Retraction of abdomen. Delirium. Facial paralysis. Death.

(1) *Operation Left Side.*—Walls of antrum carious. Curetting. Dressing.

(2) *Operation Right Side.*—Nothing abnormal.

(3) Operation of left sinus and removal of two thrombi.

(4) Death in spite of exposure of dura and opening of a cerebral abscess.

Post-mortem.—Two abscesses in left cerebellum, one of which communicated with the operation wound.

63. D'HOORE (*La Presse Oto-Laryngol. Belge*, Nr. 11). Woman aged 30.

Chronic Left Otorrhœa.—Pulse normal. Temperature 37°.

Operation (simple chiselling out).—Pain in forehead and occiput. Left facial paralysis. Constipation. Vomiting. Dilatation of bloodvessels in left fundus oculi.

Operation.—A fistula in a posterior direction led to an extradural abscess of the posterior cranial fossa, which was evacuated. Temperature and pulse normal. Prostration. Slowing of pulse. Delayed respiration.

Operation.—Evacuation of cerebellar abscess.

No post-mortem.

64. HOLSCHER (*A. f. O.*, Bd. 52).

Chronic Left Otorrhœa.—Headache. Vomiting. Nystagmus on looking to the right. No fever.

Post-operation.—Opisthotonos. Death due to paralysis of respiration.

Operation.—Sclerosis of bone. Antrum small and full of pus. Fistula extending far backwards. Dura covered with granulations. Sinus could not be found.

Post-mortem.—Abscess in left cerebellum. Left transverse sinus obliterated. Compensatory new formation of a right sinus.

65. HOLSCHER (*Ibidem*). Girl aged 11.

Chronic Left Otorrhœa.—Vomiting. Headache. Fever. Rigor.

Post-operation.—Stiffness of neck. Death.

Operation.—Large subperiosteal abscess. Pus in mastoid process. Purulent degenerated thrombus in sinus. Puncture of cerebellum negative.

Post-mortem.—Cerebellar abscess.

66. JACQUES (*Revue Hebdom. de Laryng.*, 1903). Man aged 23.

Chronic Otorrhœa.—On lumbar puncture opaque fluid was obtained under high pressure, containing polynuclear leucocytes and an unknown bacillus.

In fluid from a second lumbar puncture were mononuclear leucocytes and the *Bacillus mesentericus* (Fluegge).

Post-operation.—Cerebral symptoms.

Radical Operation.—Tegmen destroyed. Extradural abscess on posterior surface of petrous bone. Evacuation. Drainage. Death.

Post-mortem.—Three abscesses in cerebellum. Neglected wound after chiselling out.

After the first operation: Lumbar puncture, which was clear without rise of pressure. No formative elements. *Bacillus* of Fluegge.

Operation.—Large sequestrum. Dura exposed; necrotic focus in cerebellum behind transverse sinus.

Ten days after operation second operation. A thin shell of grey substance was the only trace remaining of the right cerebellar hemisphere. Drainage three and a half months after operation. Death.

No post-mortem.

67. JACQUES (*Ibidem*). Ten-year-old boy. Neglected wound.

68. KNAPP (*M. f. O.*, Bd. 42). Man aged 26.

Chronic Left Otorrhœa.—Headache. Vertigo. Granulations in meatus. Hearing less acute than normal. Temperature 39° .

After first operation: Headache. Nausea. Left facial paralysis. Nystagmus to left. Gait uncertain. Temperature 38.5° .

After second operation: Delirium. Nystagmus to left. Vomiting. Rigidity of neck. Left facial paralysis. Temperature 39.3° . Lumbar puncture negative. Death.

First Operation.—Cholesteatoma in middle ear. External meatus destroyed. No labyrinthine suppuration. No fistulous tract.

Second Operation.—Incision of cerebellum negative. Labyrinth full of discoloured granulations.

Third Operation.—Incision of cerebellum negative.

Post-mortem.—Purulent meningitis on convexity of brain. Pons, crus cerebri, and fourth ventricle, bathed in pus. Unencapsuled abscess near flocculus in left cerebellum. This abscess appeared to communicate with the fourth ventricle. Sinus normal.

Path of Induction.—The infection travelled through the porus acusticus internus and caused pachymeningitis, with adhesion of the cerebellum, and a cerebellar abscess, which ruptured into the fourth ventricle.

69. KÜMMEL (*Beiträge zur Ohrenheilkunde*, 1905). Man aged 34.

Chronic Left Otorrhœa.—Left facial paresis. No vertigo. Granulations in left meatus. Vomiting. Headache. Temperature 38.8° – 39° . Pulse 96–112. No nystagmus. Lateral oscillation.

Post-operation.—Indolence. Temperature 39.6° . Pulse 64. Left optic neuritis.

After second operation: Temperature 37° . Pulse 50. Evening 39.6° . Pulse 90.

After third operation: Vomiting. Pulse irregular. Four days later, on changing the dressing, there was a sudden discharge of pus from the cerebellum. Horizontal nystagmus on looking to the left. Temperature 37° . Pulse 66. Later rigidity of neck. Nystagmus on looking to right. On looking towards the left the patient is unable to see above the middle line. Cheyne-Stokes respiration. Death.

Left visual paresis. Nystagmus to left, later towards right. Labyrinthine suppuration.

First Operation.—Sclerosis of mastoid process. Cholesteatoma in antrum. Fistulous aperture in horizontal semicircular canal, from which pus exudes. Lateral and postero-vertical semicircular canals dilated and full of granulations. Dura of posterior cranial fossa normal. No pulsation. The vestibule was opened from the exposed lateral semicircular canal, and the oval window enlarged in a downward direction. Artificial respiration was undertaken owing to asphyxia.

Second Operation.—Exposure of dura as far as the sinus, in a median direction as far as the saccus, which, however, could not be recognized. On incision of the dura there was an escape of clear fluid. Cultures sterile. (H_2O_2 ?)

Third Operation.—Exposure of dura of middle cranial fossa to tegmen tympani; incision of dura negative. Drainage. Death.

Autopsy.—Pia intact. Sinus normal. Large abscess cavity in left cerebellum, the surrounding tissue being extremely encephalitic. Porus acusticus internus, aquæductus cochleæ, and hiatus subarcuatus, free from pus. Probable path of induction from labyrinth into ductus endolymphaticus and sacculus (?).

70. KÜMMEL (*Z. f. O.*, Bd. 28). Man aged 61.

Acute Left Otitis Media.—Left mastoid process susceptible on palpation. No vertigo. No fever. Pulse normal.

A few days later: Uncertain gait. Vertigo. Dull percussion sound over left mastoid process. No fever.

Post-operation.—Cure.

Operation.—Small rough spot on floor of antrum, from which a small fistulous tract passed in a median direction. In order to expose this, a fairly large piece had to be removed from the posterior pyramidal surface, so that the dura of the posterior cranial fossa was laid bare in a median direction from the sigmoid fossa, between it and the jugular foramen. The dura and sinus did not pulsate, but were apparently normal. In the deep tissues a fairly large perforation in the bone suddenly came in view, and pus escaped simultaneously. Evacuation of the abscess.

Kümmel believed that this was a case of empyema of the saccus endolymphaticus.

71. LANNOIS AND ARMAND (*Arch. Intern.*, 1903). Boy aged 17.

Chronic Left Otitis Media.—Irregular fever. Headache. Stupor. Temporary improvement after opening antrum. Later epileptiform tremors in right lower leg.

Puncture of left temporal lobe and cerebellum. Abscess in latter. Death.

Post-mortem.—Diffuse suppuration of labyrinth. Discoloration and thickening of facialis and acusticus. Bone and sinus normal. Two abscesses in left cerebellar hemisphere, not communicating with one another.

72. LAURENS (*Annales des Maladies*, etc., 1903). Woman aged 29.

Acute Right Otitis Media.—Headache. Emaciation. Rigors. Fever. Stupor. Lumbar puncture negative.

Post-operation.—Severe localized pain over antrum. Slowing of pulse. Fever. Healing.

Operation.—After ligation of the jugular, which was apparently intact, the mastoid process was cleared out; the sinus, together with a perisinuous abscess, was opened, and through the wall of the sinus a foetid cerebellar abscess, situated at a depth of about 2 cm., was also opened.

Second Operation.—Exposure of tegmen antri. Dura of a greenish colour. Incision and evacuation of temporal lobe abscess.

Route of Induction.—Anthritis, originating in tympanic cavity; diffuse mastoiditis and perisinuous abscess. Resulting phlebitis and cerebellar abscess.

The temporal lobe abscess was due to pachymeningitis of the posterior cranial fossa.

73. LEUTERT (*A. f. O.*, Bd. 41). Boy aged 11.

Chronic Otorrhœa and Cholesteatoma on Right Side.—Headache. Fever. Opaque fluid on lumbar puncture.

Diagnosis.—Thrombosis of sigmoid sinus. Meningitis.
No operation.

Post-mortem.—Purulent basal meningitis. Fibrinous deposit on right temporal bone corresponding to orifice of aquæductus vestibuli. Dark red blood-clot in lower portion of sigmoid sinus, attached to a small point in the wall of the cerebral sinus, the latter being affected by purulent infiltration. Cochlea and acusticus normal. Purulent masses in superior semicircular canal.

74. LOOPUYT (*Soc. Holland. Oto-Rhino-Laryngol.*, 1903).

Otitic Cerebellar Abscess.

Operation.—Cure.

Papillitis could still be demonstrated nine months after the operation.

75. LOSSEN (*Beiträge zur Klin. Chir.*, Bd. 39). Boy aged 17.

Chronic Left Otorrhœa.—Temperature 38.5° – 39° . Head held obliquely towards the left. Rigidity of neck. Occipital pain. Horizontal nystagmus. Left choked disc. Vertigo. No vomiting. Fœtid pus and granulations in middle ear. Bradycardia.

Post-operation.—Normal temperature. Pulse 80. No headache. No nystagmus. No rigidity of neck. Sudden death.

Clinical Diagnosis.—Acute mastoiditis. Thrombosis of sinus and jugularis and left cerebellar abscess.

Radical Operation.—Cholesteatoma and granulations in antrum and tympanic cavity. The thrombosed sinus lies in an ichorous persinuous abscess. Ligature and cutting through of sinus. Ligature and resection of discoloured jugular. Puncture of temporal lobe negative. Exposure

of cerebellum. Dura green colour; no pulsation. Nut-sized ichorous abscess with thick membrane discovered on incision of cerebellum. Drainage. Tamponage. Dressing.

Anatomical Diagnosis.—Otitis media purulenta. Sinus thrombosis. Thrombosis of jugularis. Perisinuous abscess and cerebellar abscess on left side.

Autopsy.—Nut-sized abscess in left cerebellum, which had ruptured in a downward and outward direction. Organ of hearing on right side intact. Pus on pons and medulla oblongata. Basal meningitis.

76. Same reference. Man aged 29.

Left Chronic Otorrhœa.—Seven days ago pain in ear. Rigors. Inclination to retching. Head held stiffly to the left. Temperature 40.5° . Pulse 60. Horizontal nystagmus. No choked discs. Fœtid pus in left ear. Hearing power diminished. Right ear intact.

Post-operation.—Temperature 39.2° . Pulse 80. No vomiting. Healing.

Clinical Diagnosis.—Purulent mastoiditis; thrombosis of sinus and jugularis. Cerebellar abscess.

Radical Operation.—Mastoid process, attic, and antrum, full of ichorous pus and cholesteatoma. Sinus thrombosed and bathed in pus. Ligature and clearing out of ichorous thrombi from sinus. Exposure and total extirpation of thrombosed and discoloured jugularis. Exposure of cerebellum. Dura green in colour; no pulsation. Nut-sized ichorous abscess found on incision of cerebellum. Drainage. Dressing.

Anatomical Diagnosis.—Cholesteatoma. Purulent otitis media. Thrombosis of sinus and jugularis. Extradural and cerebellar abscess on left side.

77. Same reference. Girl aged 5.

Chronic Left Otorrhœa.—Mastoid process susceptible on pressure. Fœtid pus in left ear.

After first operation: Temperature 39°. Somnolence. Exophthalmos on left side. Left optic neuritis.

After second operation: Exophthalmos also on right side. Apathy. Somnolence. Death.

Clinical Diagnosis.—Mastoiditis. Left sinus thrombosis and cerebellar abscess.

First Operation.—Chiselling out. Bone of petrous portion carious. Cholesteatoma. Sinus intact. Removal of necrotic malleus and incus. Bone removed to middle cranial fossa. Tamponage.

Second Operation.—Chiselling out over temporal lobe. Puncture negative. Exposure of cerebellum; pus on puncture. Opening of abscess. Sinus thrombosed; removed by ligature. Ligature and resection of jugular. Dressing.

Anatomical Diagnosis.—Mastoiditis. Left sinus thrombosis. Left cerebellar abscess.

Autopsy.—Purulent meningitis of convexity of brain; cerebellar abscess. Thrombosis of right transverse sinus, jugularis, and cavernous sinus.

78. Same reference. Man aged 27.

Chronic Left Otorrhœa.—Sensorium benumbed. Left side of skull tender on percussion. Pain in occiput and forehead. Stiffness of neck. No nystagmus; no choked discs. Temperature 40°.

Post-operation.—Left facial paralysis; difficulty in swallowing. Death from arrest of respiration and cardiac action.

Clinical Diagnosis.—Suspicion of sinus thrombosis and cerebral abscess.

Radical Operation.—Perforation in bone of mastoid process, from which there is a discharge of ichorous pus. Internal and external jugular thrombosed and ichorous. Sinus thrombosed and bathed in ichorous pus, which extends into middle cranial fossa. Purulent discoloration of dura of temporal bone and tentorium. Removal of sinus, which is filled with ichorous material. Exposure of cerebellum, the upper surface of which is greenish-yellow. Ichorous abscess the size of a hen's egg in cerebellum. No pus in temporal lobe. Tamponage. Dressing.

Anatomical Diagnosis.—Purulent otitis media. Cholesteatoma in cavum tympani. Perforation of tegmen tympani and anterior wall of mastoid process. Epidural abscess in median cranial fossa. Thrombosis and putrefaction of transverse sinus, and of the whole of the jugular vein as far as the clavicle. Abscess of posterior cranial fossa, and abscess of the size of a hen's egg in left cerebellar hemisphere.

Autopsy.—Basilar meningitis. Hydrocephalus internus. Cerebellar abscess encountered in clearing out. Putrefaction and necrosis of left lateral sinus. Septic splenic tumour.

79. Same reference. Woman aged 22.

Chronic Otorrhœa and Hardness of Hearing on Right Side.—Right caput obstipum. Head held immovable towards the right. Rigidity of neck. Stupor. Occipital pain. Jugular susceptible on pressure. No fever. Fundus oculi normal. Reflexes normal. Pulse 120. Death.

Diagnosis.—Middle-ear suppuration. Right sinus thrombosis. Thrombosis of right jugular. Right cerebellar abscess. Basilar meningitis. Sepsis. Pregnancy. The child was delivered alive by Cæsarean section. Death on the same evening.

Autopsy.—Meningitis of convexity of brain. Fibrinous deposit of the pia mater of the base. Hydrops of the fourth ventricle. Pear-sized abscess in right cerebellum. Perforation of petrous bone along sheath of auditory nerve. Cholesteatoma of tympanic cavity, with erosion of petrous bone and perforation of tympanic membrane. Thrombosis of right sinus and jugular. Septic tumour of spleen.

So. Same reference. Man aged 26.

Chronic Left Otorrhœa.—Four weeks ago secretion from both ears. Stupor. Forgetfulness. Restlessness and irritation. Temperature 38.5° . Pulse 68; dicrotic. Head held obliquely towards the left. Fœtid pus in both ears. Complete deafness in left ear; hearing power diminished in right. No nystagmus; no papillitis.

Clinical Diagnosis.—Bilateral purulent otitis media. Left mastoiditis. Thrombosis in left sinus and jugular. Left cerebellar abscess. Cure.

Radical Operation.—Cholesteatoma in attic. Perforation of tegmen tympani. Exposure of middle cranial fossa. No pulsation of dura. Puncture of temporal lobe negative. Exposure of sinus, which was thrombosed and the wall discoloured. Sinus removed by ligature. Ligature and resection of jugular. Enlargement of trephine wound posteriorly. Exposure of cerebellum. No pulsation of dura. Ichorous nut-sized abscess revealed on incision. Drainage. Dressing.

Anatomical Diagnosis.—Cholesteatoma of left ear. Purulent mastoiditis. Thrombosis of sinus and jugularis. Left cerebellar abscess.

81. Same reference. Boy aged 17.

Chronic Left Otorrhœa.—Pain in forehead. No fever. Stupor. Vertigo. Vomiting. Bilateral occipital pain. Rigidity of neck. Irregular respiration.

Clinical Diagnosis.—Cerebellar abscess; meningitis.

Operation refused.

Exophthalmos. Cheyne-Stokes respiration. Death.

Autopsy.—Left cerebellar abscess with eruption into fourth ventricle. Basilar meningitis. Sclerosis of bone of left ear.

82. Same reference. Man aged 22.

Chronic Left Otorrhœa.—Rigors two days before seen. Nausea. Vertigo on sitting up. Susceptibility on pressure over mastoid process, cervical vertebræ, and jugularis. Foetid pus in left ear. Left disc reddened. Temperature 38.3° .

Clinical Diagnosis.—Sinus thrombosis. Suspected cerebellar abscess.

After first operation: Temperature 39.4° . Pulse 80. Stupor. Vomiting. Horizontal nystagmus. Somnolence.

After second operation: Temperature 38° . Pulse irregular. Vomiting. Spasms. Cheyne-Stokes respiration. Somnolence. Sudden death during catheterization, due to paralysis of respiration.

Operation.—Pus in antrum. Cholesteatoma in attic. Auditory ossicles absent. Sinus thrombosed. Wall discoloured. Sinus lies in an extradural abscess, which occupies the whole of the posterior cranial fossa. Ligature

of jugular, which contained a thrombus. Cutting through and clearing out of the sinus. Puncture of cerebellum from posterior cranial fossa negative.

Second Operation.—Enlargement of the opening with Luer's forceps. No pulsation of dura. Puncture of cerebellum negative. Abscess the size of a hazelnut was found on incision. Drainage. Dressing.

Autopsy.—Left cerebellum softened. Two opened abscess cavities on the left apex, and in the middle of the left segment of the cerebellum. Hydrops of all four ventricles. Œdema of medulla oblongata and pons. No thrombi in sinus and vein. Hypostatic pneumonia on left side.

83. Same reference. Girl aged 16.

Chronic Right Otorrhœa.—Head held stiffly. Cervical musculature contracted. Jugularis susceptible on pressure. Mastoid process and skull insusceptible on palpation. No paralyses. Occiput tender on pressure. Temperature $49\cdot1^{\circ}$. Pulse 132; dicrotic. Fundus oculi not examined. Special senses normal.

Clinical Diagnosis.—Thrombosis of sinus and jugular. Right cerebellar abscess.

After first operation: Stupor; restlessness. Temperature $37\cdot9^{\circ}$ – $40\cdot1^{\circ}$.

After second operation: Temperature $40\cdot5^{\circ}$. Somnolence. Death.

First Operation.—Exposure of middle and posterior cranial fossæ. Sinus thrombosed and contains blood-clot. Double ligature of sinus. Dura of cerebellum gangrenous. Pus on incision. Dressing.

Second Operation.—Enlargement of trephine opening anteriorly and posteriorly. Another abscess in median line opened in right cerebellum.

84. Same reference. Boy aged 18.

Chronic Right Otorrhœa.—Pain in forehead and nape of neck; vertigo; vomiting. Temperature 39° . Senses dulled. Rigidity of neck. Tenderness below and behind mastoid process. Pulse 92. *Right Ear*: masses of granulations. *Left Ear*: pus in tympanic cavity. Lumbar puncture showed high pressure. No cocci. Abundant leucocytes.

Post-operation.—Temperature 36.5° . Pulse 72. Rigors. Fundus oculi not examined. Vertigo; facial paresis; somnolence; pain in forehead; vomiting. Nystagmus on looking to left. Rigidity of neck. Respiration irregular.

Clinical Diagnosis.—Abscess in one of the cerebellar hemispheres, probably the right.

After second operation: Temperature 36.5° . Pulse 108. Disappearance of deviation of eyes. Horizontal nystagmus. Healing.

Radical Operation.—Stacke's operation on right side. Auditory ossicles necrotic. Cholesteatoma in attic. Necrosis of tegmen tympani. Dura of middle cranial fossa normal. Sinus normal. Dressing.

Second Operation.—Enlargement of wound posteriorly with Luer's forceps. Sinus normal. No change in dura, though it did not pulsate. Pus on incision of cerebellum. Drainage. Tamponage.

Radical Operation (Left).—Antrum full of granulations. Dura exposed for a small area in the region of the tegmen tympani. Incus diminished in size. Malleus intact. After the operation the patient exhibited conjugate deviation towards the left, and subsequently divergent strabismus and right facial paralysis.

Anatomical Diagnosis.—Cholesteatoma in both ears. Meningitis serosa. Abscess in right cerebellum. Cure.

85. MAYNARD (*Indian Med. Gaz.*, 1899). Male aged 18.

Acute Left Otorrhœa.—Temperature 40.5° . Dulness; diffuse headache; constipation; vomiting. Pupils normal; the right reacted sluggishly. Stiffness of neck. Cheyne-Stokes respiration.

Operation.—Pus in antrum. No pus in cerebrum and cerebellum, in spite of repeated punctures.

Post-mortem.—Orange-sized abscess in left cerebellar hemisphere. Thrombosis of lateral sinus.

86. MILLIGAN (*Trans. of Otol. Soc. of the United Kingdom*, 1900). Man aged 42.

Occipital pain. Vomiting. Constipation. Vertigo. Slowing of pulse. Temperature normal.

Operation.—No pathological contents in tympanic cavity. Some pus in mastoid process. Just as the supposed cerebellar abscess was about to be operated upon, there was sudden arrest of respiration. On evacuation of the abscess respiration returned spontaneously.

Second Operation.—Evacuation of a second cerebellar abscess. Death due to purulent basal meningitis.

87. MILLIGAN (*Arch. Intern.*, 1905, Bd. 20).

Case of cerebellar abscess.

88. MOLINE (*Trans. Soc. Franc. d'Otol.*, 1903).

Suppuration of the labyrinth associated with cerebellar abscess.

89. MOORE (*The Post-Graduate*, 1900).

Chronic Otorrhœa.—Severe acute symptoms after a sea-bath, which led to acute mastoiditis. No pus on opening of mastoid process. Headache; vomiting; vertigo; rigors. Death one month after mastoid operation.

Post-mortem.—Caries of mastoid process reaching to the parieto-occipital suture, and upwards to the temporo-parietal suture. There was an aperture in the latter suture which, at the level of the lateral sinus, led into the cranial cavity. The sinus resembled a fibrous cord. Dura adherent to longitudinal sinus. Pus in posterior cranial fossa between bone and dura. Walnut-sized abscess in right cerebellar hemisphere. No pus in mastoid process, and only a few drops in the tympanic cavity.

90. MUCK (*Z. f. O.*, Bd. 35). Boy aged 12.

Chronic Right Otorrhœa.—Pain in right ear. Vertigo. Vomiting. Senses not clear. Eyes normal. Pus and granulations in cupular space. Operation. Cure.

Operation.—A small fistulous tract through sclerosed bone was found at a depth of 1 cm., and from this pus was discharging. Empyema of saccus endolymphaticus, its wall adjacent to the bone being destroyed. This empyema was limited externally at the sinus, which in its lowest portion was raised from the sulcus by granulations and pus. At this point the wall of the sinus was greyish-yellow; greyish-red at the corpus geniculatum. Sinus and cerebellar side of saccus empyema pulsating. No thrombus in it. The granulations were scraped out. The bone near the apex was soft, and infiltrated by granulations and pus, so that the entire apex had to be excised. Cure.

91. MUCK (*Z. f. O.*, Bd. 37). Man aged 40.

Chronic Right Influenzal Otitis.—Pus and granulations in meatus. Pulse 80. Mastoid process susceptible on pressure.

Post-operation.—Fundus oculi and ocular muscles

normal. Temperature normal throughout course of illness. Healing.

Operation.—Lentil-sized perforation, which led into a cavity extending to the antrum, full of pus and granulations. The bone was destroyed in the neighbourhood of this cavity as far as the dura of the middle cranial fossa, so that the upper wall of the cavity was formed only by the discoloured dura. A fistula extended backwards from the cavity, out of which pulsating pus escaped. The dura, infiltrated by granulations, was exposed in a median direction from the sigmoid ligament by dilatation of the canal. The dura cerebellum pulsated, and with each pulsatory elevation pus exuded from the perforation in the dura. Incision and drainage of the cerebellar abscess. Cure.

92. MÜLLER (*A. f. O.*, Bd. 50). Girl aged 18.

Chronic Right Otorrhœa.—Headache; apathy; hesitating speech. Head tender on percussion. Head was carefully kept immovable. Romberg positive, with tendency to fall backwards. Right pupil dilated. Severe nystagmus. Right disc obliterated. Patellar reflex absent. Temperature 39·4°. Pulse 126.

Post-operation.—Rigor. Temperature 40·6°.

Operation.—Antrum, aditus, and tympanic recess, full of cholesteatoma. Median and posterior wall of antrum carious. Necrotic fistulous aperture led into posterior cranial fossa. Dura over aperture and sinus discoloured. Fœtid pus on puncture of cerebellum. On trephining of the occiput much fœtid pus was found on the cerebellar abscess. Drainage. Death.

Post-mortem.—Cherry-sized abscess in cerebellum in addition to the one operated upon. Sinus discoloured and covered with granulations.

93. MÜLLER (*A. f. O.*, Bd. 50). Girl aged 10.

Chronic Left Otorrhœa.—Vomiting; headache; epistaxis. Temperature 37.9° . Pulse 72. Stupor. Oscillation to the left on walking. Romberg positive. Movements of head painful. Head kept immovable and stiff. Left papilla obliterated. Vomiting; sopor; delirium; vertigo; pain in neck.

Post-operation.—Vertigo on attempting to get up. Vomiting; constipation; apathy. Cure.

Operation.—Antrum full of granulations. Dura and sinus exposed. Fœtid pus obtained on puncture of cerebellum. Enormous discharge of pus on incision. Dressing. The prolapsed cerebellum was excised, and the cerebellum repeatedly punctured on changing the dressings.

94. NICOLL (*Glasgow Medico-Chirurg.*, 1899). Male aged 26.

Chronic Left Otorrhœa.—Pain; diffuse headache; facial paralysis; vomiting; rigors. Susceptibility on pressure over mastoid process. Stupor.

Post-operation.—Apathy. Pupils unequal. Temperature subnormal. Pulse 96. Left pupil dilated. Cure.

Operation.—Opening and evacuation of antrum, in which were granulations and cholesteatoma. Sinus normal.

Second Operation.—Abscess at margin of occipital bone. Trephining of posterior cranial fossa. Opening of a cerebellar abscess communicating with the former.

95. ORNE-GREEN (*Amer. Journ. of Med. Sci.*, 1899). Male aged 18.

Chronic Left Otorrhœa.—Aural pain; vertigo; no fever; no vomiting; left facial paralysis. Left tympanic

membrane perforated and reddened. Delirium and sopor after clearing out the tympanic cavity.

Operation.—Death.

Operation.—Opening of mastoid process. Exposure of cerebellum opposite lateral sinus. Sinus intact. Escape of clear fluid and a few drops of thick pus on incision of dura. Staphylococci in both. Incision of cerebellum negative.

Autopsy.—Cerebellum corresponding to orifice of aquæductus vestibuli adherent to dura. Nut-sized abscess in left cerebellar hemisphere. Acusticus swollen and discoloured. Adhesion of dura to surface of cerebellum in region of porus acusticus internus. Extensive caries of the whole of the bony labyrinth, the oval window and the horizontal portion of the Fallopian canal, the external and superior semicircular canals, and the antrum.

96. ORNE-GREEN (*Trans. of Amer. Otol. Soc.*, 1898).

Carious erosion into the labyrinth with consecutive cerebellar abscess.

Three cases of chronic otitis media with carious eruption into the external semicircular canal, and in two cases simultaneously into the superior semicircular canal. In two cases the horizontal section of the Fallopian canal was completely destroyed in the tympanic cavity; in one the caries had reached the tympanic cavity from the wall of the labyrinth and extended to the whole of the bony labyrinth, so that it was already distinctly visible on the superior and posterior pyramidal surface. In each case the result was an abscess in the anterior and inferior portion of the cerebellum, the infection having spread farther in two instances by way of the internal meatus, and in one through the aquæductus vestibuli.

97. PANSE (*A. f. O.*, Bd. 33).

Chronic Left Otorrhœa.—Pain in left ear. Vertigo; pain in forehead and vertex. Hyperæsthesia of scalp. Facial tremors. Jugular vein susceptible on pressure. Head could be rotated freely.

Post-operation.—Coma. Temperature 41° . The left side was completely deaf for high and deep tones. C¹ was lateralized to the right in all parts of the vertex. Death.

Operation.—Opening of mastoid process. Bone externally intact. Pus and cholesteatoma at a depth of 5 mm. Dressing.

Post-mortem.—Convexity of left cerebral hemisphere covered with pus. Left cerebellum fixed to jugular foramen. Dura above the transverse ligament in the vicinity of the jugular foramen firmly attached to the bone. Pus in porus acusticus internus and at orifice of aquæductus vestibuli. In the transverse sulcus there was a lentil-sized perforation, due to erosion from cholesteatoma, but occluded by dura. Abscess the size of a pigeon's egg in cerebellum. Pus at hiatus aquæductus vestibuli and nerve trunks. Membrane of lamina spiralis thickened and injected.

98. PANSE (*A. f. O.*, Bd. 56).

Post-mortem.—Entry of pus through fenestra ovalis. Suppuration of the entire labyrinth with the aqueducts. Purulent inflammation in internal meatus. Death from cerebellar abscess.

99. PHILIPPS (*Z. f. O.*, Bd. 41). Man aged 21.

Acute Left Otorrhœa after Influenza.—Mastoid process susceptible on pressure. Temperature 37.6° . Pulse 80. Convexity in region of tegmen tympani.

Operation.—Pus in antrum. Incision of lateral sinus negative. Dressing.

Second Operation.—Enlargement of operation wound posteriorly. Pus on incision of cerebellum. Evacuation of abscess. Drainage. Dressing.

Post-operation.—Nausea ; vomiting ; apathy. No choked discs. Left optic nerve hyperæmic. After second operation : Severe headache ; vomiting ; fundus oculi not observed. Temperature 37.2° . Death.

Post-mortem.—External surface of cerebellar hemispheres covered with pus. Opening in base of skull on left side, corresponding to mastoid process, measuring about 1 cm. in diameter, which communicated externally with the wound in the mastoid process and internally with the cerebellar abscess.

100. PINDER (Ref. in *Arch. Intern.*, 1905, Bd. 20, Nr. 6).

Cerebellar abscess ; basilar meningitis ; incision of abscess ; evacuation of foetid pus. Opening of mastoid process. Exploration of cerebellum and frontal lobe. Progressive improvement. Hernia cerebelli.

101. PREYSING (*A. f. O.*, Bd. 51). Man aged 23.

Chronic Left Otorrhœa.—Intense occipital pain. Uncertain gait ; Romberg positive, oscillation especially towards right. Slow pulse. Temperature 37.5° .

Post-operation.—Horizontal nystagmus on looking to right. Somnolence. Temperature 38.5° . Eyes directed downwards. Pupils contracted ; sluggish reaction. Pulse 80. Rigidity of neck. Patellar reflex exaggerated. Ankle clonus. Lumbar puncture negative.

After second operation : Eyes resumed normal position. Nystagmus continued. Pupils dilated ; prompt reaction to light. Slight bilateral optic neuritis. No fever. Cure.

Operation.—Pus in mastoid process. Dura on tegmen antri exposed. Bone discoloured. Sinus surrounded by granulations. Pure venous blood obtained on puncture of sinus. Dressing.

Second Operation.—The region of the external semi-circular canal, into which a fistula led, was cut away. Tegmen tympani excised. Dura intact. A portion of the tabular part of the occipital bone was chiselled away. Dura cerebelli intact. Pus on puncture of cerebellum. Incision and evacuation of abscess. Dressing. Cure.

102. PREYSING (*A. f. O.*, Bd. 51). Male aged 18.

Chronic Right Otitis Media.—Temperature 38.8° . Headache. Tympanic cavity infiltrated by granulations. No hearing test undertaken.

Post-operation.—Temperature 39.5° . Pain in forehead and left side of head. Hesitating speech. Unable to stand; falls backwards. Keeps head carefully in position. No fever. Fundus oculi. Death.

Operation.—Mastoid process and antrum not examined. Exposure of sinus; opening of tympanic cavity, which was full of cholesteatoma, and from it a fistulous tract reached nearly to the sinus. Fistula full of granulations.

Second Operation.—Puncture of brain negative.

Post-mortem.—Extradural abscess in immediate vicinity of trephine opening, with small perforation of dura. Abscess of right segment of cerebellum corresponding to this point.

103. PREYSING (*A. f. O.*, Bd. 51). Man aged 56.

Chronic Left Otorrhœa.—Intense pain in occiput. Emaciation. Pupils equal. Prompt reaction to light. Fundus oculi not observed. Whisper left 6 m. Loss of speech. Weber to left.

Post-operation.—Difficulty in swallowing. No fever. Healing.

Radical Operation.—Bone infiltrated with pus. Sinus obliterated. A large defect in the bone led to necrotic cerebellar substance. Tympanic cavity scraped out, so that the tympanic cavity, antrum, and bony wound, formed a single cavity.

Second Operation.—Enlargement of the bony wound posteriorly. Necrotic portion of cerebellum excised. The jugular, though normal, ligatured. Cerebellar abscess due to sinus thrombosis.

104. PREYSING (*A. f. O.*, Bd. 51). Woman aged 26.

Chronic Left Otorrhœa.—Pain; vertigo; vomiting. On attempting to raise himself the patient sinks towards the left. Fundus oculi not observed. No fever.

Post-operation.—No fever. Tremors in right lower arm. Patellar and plantar reflexes absent. Left angle of mouth much depressed; fibrillary tremors. Pulse 100; at times 60. Sudden death.

Operation.—Granulations in antrum and attic. Dressing.

Post-mortem.—Encapsuled long-standing abscess, with thickened pus in left cerebellum. Adhesions between abscess wall and dura.

105. RANDALL (*Journ. Amer. Med. Assoc.*, 1899). Male aged 15.

Chronic Right Otorrhœa.—After a blow on the ear, pain; nausea; dulness. Mastoid process reddened and swollen. Temperature 41°.

Post-operation.—Fundus oculi normal. Death.

Operation.—Incision of subperiosteal abscess; bone sclerotic. Pus and caries in antrum. No fistula.

Post-mortem.—Abscess size of pigeon's egg in cerebellum. Dura shows no fistula. Sinus phlebitis. The abscess possesses a thick capsule, which is thinnest in the vicinity of the antrum. The abscess might well be older than the injury.

106. RANDALL (*Ibidem*). Male aged 14.

Chronic Otorrhœa.—Granulations in wall of meatus.

Post-operation.—Abscess in the clavicle. Pulse 76. Temperature 36.5°. Vomiting. Diagnosis: cerebellar abscess. Operation. Death.

Operation.—Large cavity in mastoid process, in which the sinus is laid bare and covered by granulations. Lamina interna carious. Purulent deposit on dura, which was exposed. Dressing.

Second Operation.—Exposure of middle and posterior cranial fossa. The operation was interrupted on account of injury to the mastoid vein. Death.

No post-mortem.

107. RANDALL (*Ibidem*). Child aged 4.

Chronic Right Otorrhœa, and Purulent Fistula behind Ear.—Intense pain on right side of head; vomiting; special senses normal; convulsions in left upper and lower extremities. No paralyses. Temperature 36.7°. Pulse 88. Respiration 20.

Post-operation.—Death.

Operation.—Cutting away of mastoid process. As no fistula was found, the wound was dressed.

Post-mortem.—Abscess in right cerebellum.

108. RIMINI (*Arch. Ital. di Otol.*, 1900). Woman aged 35.

Patient rapidly succumbed, without operation being undertaken, to endocranial symptoms. Thrombosis of

left jugularis and sinus. Abscesses in cerebellum, a lentil-shaped sinister one in the nucleus, and a perforating one in the ventricle. Extensive cholesteatoma in left attic. Fistula in cranial cavity on sigmoid sulcus. Malleus, incus, and stapes, not examined.

109. RÖPKE (*M. M. W.*, 1900). Girl aged 14.

Chronic Left Otitis Media.—Vertigo; vomiting; spasms; attacks of faintness; psychical change. Temperature 40°. Stiffness of neck. Delirium. Left facial paralysis.

Post-operation.—Rigor; vomiting. Temperature 39.9°. Stiffness of neck; tremors of extremities of affected side. Vertebral column susceptible to pressure. Paralysis of bladder. Death.

Radical Operation.—Granulations and stinking pus in antrum. Promontorium destroyed and replaced by granulations; on pressure of the latter pus escaped from the labyrinth. The granulations and the necrotic cochlea were scraped out with a sharp spoon. Loose tamponage. A month later the labyrinth was again scraped out.

No post-mortem.

110. RUBZOW (*Medizinskoje Obosrenije*, 1901).

Case of cerebellar abscess.

111. SCHMIEGELOW (*Arch. Intern.*, 1905). Woman aged 27.

Chronic Left Otorrhœa.—Sudden acute symptoms of retention of pus. Pulse 70. Temperature 37.8°. Apathy; left papillitis. Paralysis of respiration at commencement of chloroform narcosis.

Death at commencement of operation.

Post-mortem.—Cerebellar abscess; epidural abscess in middle cranial fossa. No caries of tegmen tympani or of posterior surface of petrous bone.

112. SCHMIEGELOW (*Arch. Intern.*, 1905). Girl aged 11.

Chronic Right Otorrhœa—Rigors; emaciation; vomiting; vertigo. Temperature 39° . Healing.

Operation.—Large cholesteatoma in mastoid process. Large perisinuous abscess in posterior cranial fossa. Incision of temporal lobe negative. Evacuation of abscess the size of a hazelnut in right cerebellum. Evacuation of a retropharyngeal and pulmonary abscess.

113. SCHMIEGELOW (*A. f. O.*, 1905). Male aged 18.

Chronic Right Otorrhœa.—Occipital pain; vertigo. Mastoid process susceptible on pressure. Temperature 38.1° .

Post-operation.—Pulse 64. Temperature 38° – 40.4° . Depression.

After second operation: Temperature 38° – 40° . Pulse 104. No nausea; no vomiting; delirium; herpes labialis. Rigors; apathy. Death.

Radical Operation.—Cholesteatoma and fœtid pus in antrum; transverse sinus intact.

Second Operation.—Trepanation of median cranial fossa and incision of temporal lobe negative.

Post-mortem.—No meningitis. No sinus thrombosis. Epidural abscess over carious focus on posterior pyramidal surface. Dura perforated. The epidural abscess communicated by an aperture with a cerebellar abscess. Walls of abscess cavity gangrenous.

114. SCHMIEGELOW (*Arch. Intern.*, 1905). Woman aged 23.

Chronic Left Otorrhœa.—Pain; vertigo; vomiting. Temperature 37.6°. Pulse 100.

Post operation.—Vomiting; vertigo. Heavy feeling on left side and in neck. Temperature 39.5°.

Radical Operation.—Cholesteatoma in middle ear. Tegmen tympani carious. Granulations on dura. Puncture of temporal lobe negative. Dressing. Result unknown.

115. SCHMIEGELOW (*Arch. Intern.*, 1905). Man aged 24.

Bilateral Chronic Otorrhœa.—Intense pain in forehead. Dulness. The neck was held stiffly owing to tenderness. The head was bent forwards on the breast and turned to the left. Pupils not examined. Left oculomotor paralysis. Pulse 72. Temperature normal. Fundus oculi not examined. Fœtid suppuration and perforation of Shrapnell's membrane. Fistula full of granulations on posterior wall of meatus. Sudden death.

No operation.

Post-mortem.—Long-standing abscess the size of a pigeon's egg in the left hemisphere. A considerable portion of the posterior pyramidal surface was destroyed, so that the cholesteatomatous masses had penetrated into the abscess cavity. On removal of the cholesteatoma a cavity was discovered communicating with the attic, so that a probe inserted through the meatus entered the cavity. The dura corresponding to the cavity was thickened, but its adhesions were not particularly firm. Sinus intact.

116. SCHMIEGELOW (*Nordiskt Medicinskt Arkiv*, 1902).

A subperiosteal abscess was present, which was on the one side connected with the meatus, and on the other

communicated with the posterior cranial fossa by means of a fistula, but not with the abscess in the bone of the mastoid process. A large epidural abscess was found in the posterior cranial fossa, which communicated with a cerebellar abscess by an aperture in the dura.

117. SCHMIEGELOW (*Z. f. O.*, Bd. 42). Male.

Chronic Left Otorrhœa.—Vertigo ; vomiting.

Post-operation.—Pain ; nausea ; fever ; rigidity of neck, and sopor. Abscess in left palatine arch. Death.

Radical Operation.—Dura intact.

Second Operation.—Exposure of transverse sinus negative. Trepanation and puncture of cerebellum negative.

Post-mortem.—Perforation in the dura corresponding to the porus acusticus internus, and in its immediate vicinity a walnut-sized abscess in the cerebellum.

118. SCHULZE (*A. f. O.*, Bd. 57). Man aged 44.

Chronic Primary Suppuration in Right Ear.

Anamnesis and Course.—Six months previously suppuration and difficulty in hearing in the right ear. Pain three days previously. Tenderness on pressure of mastoid process. Sudden severe headache two and a half months before operation. Vertigo and vomiting without fever. Twelve days later a similar symptom-complex. Radiating headache in forehead and neck. Rigor. Fever. Milky opaque fluid obtained on lumbar puncture.

Conditions found at Operation.—Removal of polypus from right meatus. Remains of granulations in the deep tissues ; carious bone behind and above. Extensive caries of walls of tympanic cavity and antrum. Ossicles

carious. A carious recess beneath the facial prominence led into the deep tissues.

Diagnosis.—Meningitis. Cerebellar abscess. Death.

Results of Post-mortem.—Purulent basal meningitis. Abscess of right cerebellar hemisphere, containing thick creamy pus. Cerebellum adherent to dura. Temporal bone. Middle-ear cavity covered by epidermis. Black discoloured piece of bone in neighbourhood of horizontal semicircular canal. Stapes absent. Granulation tissue replaced fenestra ovalis. Cochlea normal; superior semicircular canal contained pus. Dura much thickened on anterior surface of pyramid, between sigmoid fossa and porus acusticus internus. A yellow sac the size of a cherry, covered with pavement epithelium, and tense, owing to its being full of pus, was present on the inner surface of the dura at the orifice of the aquæductus vestibuli, and was ruptured at two points. The larger aperture corresponded to the spot at which the pia mater was adherent to the abscess wall. The smaller one, which was situated farther backwards, corresponded to the point of spontaneous perforation.

Path of Infection.—Operative opening of fenestra ovalis. Infection of vestibule and aquæductus vestibuli. Empyema of saccus; cerebellar abscess *per continuitatem et contiguitatem*. Subsequent meningitis from bursting of the sac. No microscopical examination of the labyrinth.

119. SIEBENMANN (*Z. f. O.*, Bd. 40). Man aged 42.

Bilateral Chronic Otorrhœa.—Complete facial paralysis on right side. Left optic neuritis. Pulse 60. Temperature 37·3°.

Post-operation.—Pain in right side of head; nausea.

Temperature 38.9°. Pulse 74. Rigidity of neck. Reflexes exaggerated. Bilateral optic neuritis.

After second operation. Diplopia; eyeballs tender on pressure. Stupor. Temperature 42°. Pulse 152. Bilateral choked discs. Paresis of right abducens; picking at bed-clothes. Purulent sputum. Rigidity of neck; head in position of torticollis to the left. Death.

Radical Operation: Right Ear.—Sclerosis of mastoid process. Granulations in antrum and tympanic cavity. No carious points. Dressing.

Second Operation.—A piece of the squamous portion of the temporal bone, about 7 cm. long and 4 cm. high, was removed by the chisel and hammer. Small perforation on anterior surface of pyramid corresponding to tegmen of aditus. At this point the dura was adherent and covered by granulations. Puncture of brain negative.

Post-mortem.—Abscess of right cerebellum. Infection of brain substance directly from the dilated aquæductus vestibuli and sacculus endolymphaticus respectively, and not from a carious portion of the semicircular canals or pneumatic cells, nor the sinus or porus acusticus internus.

120. STENGER (*Charité Annalen*, Bd. 54). Child aged 10.

Chronic Left Otorrhœa.—Vertigo; occipital pain. Pulse 104. Left pupil larger than right. No nystagmus. Ocular movements normal. Healing.

Operation.—Granulations in antrum. Pus obtained on puncture of cerebellum. Evacuation of abscess.

121. SUCKSTORF AND HENRICI (*Z. f. O.*, Bd. 44). Man aged 31.

Headache three weeks after trauma. Stupor; left facial paresis. Navicular retraction of abdomen. Rigidity of

neck; opisthotonos. Papillæ hyperæmic. Leucocytes and diplococci in fluid obtained on lumbar puncture.

Post-operation.—Meningitis. Death.

Radical Operation.—Exposure of middle and posterior cranial fossa. Dura hyperæmic and lustreless. Puncture of cerebellum and temporal lobe negative. A fistula led in a median direction from the sinus to a deep extradural abscess of the posterior cranial fossa.

Post-mortem.—Purulent meningitis of the base of the brain as far as the cauda equina. Abscess of left cerebellum the size of a hazelnut, with a membrane several millimetres in thickness, resulting from the deep extradural abscess. Old connective-tissue obliteration of left transverse sinus (latent course). Complete absence of all the ossicles. Exposure of facialis in tympanic cavity. Region of fenestra ovalis covered with dense cicatricial tissue. No pus in labyrinth.

122. SUCKSTORFF (*Z. f. O.*, Bd. 44). Man aged 31.

Chronic Left Otorrhœa.—Stupor in connection with trauma. Left facial paresis; absence of right patellar reflex. Left cremasteric reflex absent; right distinct. Herpes at tip of nose and lips. Bilateral optic neuritis. Lumbar puncture; contained leucocytes and erythrocytes in proportion of 1 : 15.

Post-operation.—Death.

Operation.—Granulations in antrum. Bone softened. Dura of median cranial fossa hyperæmic and lustreless. Granulations on sinus. Fistula leading to deep extradural abscess of posterior cranial fossa. Puncture of temporal lobe and cerebellum negative.

Post-mortem.—Purulent exudation on chiasma, clivus, and base of cerebellum. A little pus in lateral and fourth

ventricles. Abscess the size of a hazelnut in left cerebellum, having a thick membrane. Left transverse sinus obliterated by connective tissue.

Path of Infection.—Chronic otitis media. Sinus thrombosis. Extradural abscess. Cerebellar abscess.

123. TENZER (*A. f. O.*, Bd. 63). Girl aged 13.

Chronic Right Otorrhœa.—Headache; vomiting; vertigo; monotonous speech; somnolence. Head tender on palpation. Temperature normal. Pulse 80. Lumbar puncture opaque. Right optic neuritis. Cure.

Operation—Evacuation of abscess in right cerebellum.

124. TENZER (*A. f. O.*, Bd. 63). Man aged 23.

Chronic Left Otorrhœa.—Vertigo; vomiting; headache; apathy; somnolence; rigors. Paralysis of left abducens. Bilateral optic neuritis. Cure.

Operation.—Evacuation of cerebellar abscess.

125. TENZER (*A. f. O.*, Bd. 63). Man aged 27.

Chronic Right Otorrhœa.—Nystagmus; Romberg positive; vertigo; vomiting; headache; bilateral optic neuritis. Death.

Operation.—Granulations and cholesteatoma in middle ear. Sequestration of lateral and posterior semicircular canals. Sinus normal. Dura of cerebellum infiltrated by granulations. Pus on puncture. Evacuation. Drainage.

Post-mortem.—Abscess in right cerebellum. No thrombosis.

126. TENZER (*A. f. O.*, Bd. 63). Man aged 21.

Chronic Left Otorrhœa.—Vomiting; apathy. Temperature normal. Pupils sluggish. Fundus normal. Death.

Operation.—Exposure of cerebellum by external incision. Incision negative.

Post-mortem.—Abscess in left cerebellum; pachymeningitis externus of left petrous bone.

127. TENZER (*A. f. O.*, Bd. 63). Man aged 30.

Chronic Left Otorrhœa.—Emaciation; vertigo; vomiting; fever; Romberg positive; tendency to fall backwards. No tenderness of head on pressure. Left facial paralysis; nystagmus to right; speech indistinct; difficulty in swallowing; paralysis of sense of taste on left side; somnolence. Fundus not examined. Death.

Post-mortem.—Leptomeningitis. Caries of wall of labyrinth and of facial canal. Abscess in left cerebellum.

128. TENZER (*A. f. O.*, Bd. 63). Girl aged 10.

Acute Left Otitis Media.—Emaciation; vertigo; vomiting. Temperature normal. Pulse 72. Gait uncertain; Romberg positive; nystagmus; right disc obliterated. Cure.

Operation.—Pus obtained on puncture of the cerebellum from the posterior cranial fossa. Evacuation of abscess. Drainage. Dressing.

129. TENZER (*A. f. O.*, Bd. 63). Man aged 22.

Chronic Right Otorrhœa.—Headache; vertigo; vomiting. Temperature 39°. Pulse 100. Nystagmus to the right. Rigor.

Post-operation.—Apathy; right optic neuritis. Death.

Operation.—Cholesteatoma in middle ear. Sinus thrombosed. Opening of cerebellar abscess from posterior cranial fossa.

Post-mortem.—Purulent sinus thrombosis and right cerebellar abscess.

130. TENZER (*A. f. O.*, Bd. 63.) Male aged 18.

Chronic Right Otorrhœa.—Temperature 38.7°. Pulse 130 >. Apathy; headache; head tender on percussion; nystagmus. Right pupil >; left Romberg positive.

Post-operation.—Vomiting; rigors. Right disc obliterated. Death.

Operation.—Cholesteatoma in middle ear, antrum, and recess; wall of sinus discoloured. No thrombosis. Pus on puncture of cerebellum. Evacuation. Drainage. Dressing.

Post-mortem.—A second cerebellar abscess discovered, in addition to the one operated upon. Thrombosis of transverse sinus.

131. TRETRÔP (*Presse Oto-Laryngol. Belge*, 1904). Male aged 18.

Chronic Right Otitis Media.—Severe headache. Temperature 39°. Apathy; no vertigo; no vomiting. Right facial paralysis. Pulse accelerated. Optic neuritis.

Post-operation.—Severe vomiting; headache; amaurosis.

Operation.—Antrum full of granulations. No thrombosis of sinus or jugular. Dressing.

Post-mortem.—No meningitis. Cystic space full of pus in right cerebellar hemisphere. A second abscess behind it in the cerebellum.

Trétrôp believes that the toxin of the old cerebellar abscess, secreted from the antrum and mastoid process, had led to inflammation.

132. TRETRÔP (*Soc. Belge d'Otol.*, etc., 1904).

Latent cerebellar abscess in a patient; the antrum and attic were chiselled away.

133. UEBERMANN (*Z. f. O.*, Bd. 46). Boy aged 12.

Chronic Right Otorrhœa.—Decrease of hearing-power and tinnitus in the right ear. No vomiting; no vertigo; headache on right side. Temperature 37.5° .

Post-operation.—Soporific; restless. Vomiting. Temperature 37° . Fundus oculi not examined. Right hand-grasp weakened.

After second operation: Temperature 36.1° – 36.9° . Vomiting; rigidity of neck. Death.

Radical Operation.—Sclerosis of bone. Antrum and attic full of granulations. Evacuation of epidural abscess after removal of the tegmen. Dura normal. Dressing.

Second Operation.—Trephining downwards and backwards in cerebellar region. Nut-sized abscess revealed on incision of cerebellum. Tamponage. Dressing.

Post-mortem.—Three abscesses in cerebellum.

134. UEBERMANN (*Z. f. O.*, Bd. 46). Woman aged 25.

Chronic Right Otorrhœa.—Pain in right ear. Rigors; headache; no vomiting, but vertigo in the upright position. Rigidity of neck. Temperature 39.3° . Fœtid pus and cholesteatoma in meatus. Hearing power diminished. Somnolence.

Post-operation.—Vomiting; occipital pain; stupor. Pulse 60. Temperature 36° – 37.3° .

After second operation: Vomiting; somnolence; choked discs; delirium.

After third operation: Horizontal nystagmus; conjugate deviation to the right; pupils dilated. Paresis of left abducens; anamnestic aphasia; partial paraphasia. Cheyne-Stokes respiration. Death.

Radical Operation.—Bone sclerotic. Cholesteatoma of

antrum. Very pulsating pus evacuated from exposed sinus. Dressing.

Second Operation.—Bone removed from sinus in a downward and posterior direction. Traces of flaky pus obtained on puncture of temporal lobe. About 100 g. of fœtid pus escaped on incision.

Third Operation.—Trepanation above the corpora geniculatum of the sinus. Membranes normal. A tablespoonful of pus at a depth of about 5 cm. Drainage. Dressing.

Post-mortem.—Multiple temporo-sphenoidal abscesses. Abscess of the left cerebellar hemisphere. No meningitis.

135. Voss (*Charité Annalen*, Bd. 27). Woman aged 30.

Chronic Left Otitis Media.—Shivering; headache. Albumin in urine. Fundus oculi normal. Horizontal nystagmus to the left more severe than towards the right. Romberg's sign showed oscillation to the left. Temperature 37.4° . Pulse 84.

Post-operation.—No fever. Somnolence; pain and tenderness on percussion in occiput. Rigidity of neck. Pulse 60. Constipation. Left disc obliterated. Temperature 36.8° . Death.

Operation.—Granulations and cholesteatoma in middle ear. No path of conduction into cranial cavity.

Post-mortem.—Abscess in left cerebellum; thrombosis of left sigmoid sinus, the transverse and petrosal sinuses. Leptomeningitis on left margin of posterior cranial fossa.

136. Voss (*Z. f. O.*, Bd. 42). Man aged 31.

Chronic Right Otorrhœa, resulting from Trauma.—Pain on right side of head; vomiting; no vertigo; fundus normal.

Post-operation.—Œdema of right upper lid. No vertigo. Staggering gait. Bilateral optic neuritis.

After second operation: No headache; optic neuritis less severe. Temperature normal throughout whole course. Cure.

First Operation.—Sclerosis of mastoid process. Cholesteatoma in middle ear. Incision of temporal lobe negative. Dressing.

Second Operation.—Enlargement of wound. Exposure of corpora geniculata and descending crus of transverse sinus. Wall of sinus thickened and showed no pulsation. Thrombus not pigmented. Abundant foetid pus obtained on incision of cerebellum. Enlargement of opening with dressing forceps and finger. Contra-incision on the finger, in an occipital direction from the sinus. Tamponage of the cavity from both openings. Dressing.

137. WAGGETT (*Sixty-seventh Meeting of the Brit. Med. Assoc.*, 1899). Man aged 26.

Chronic Right Otorrhœa.—Radical operation owing to the sudden onset of facial paralysis.

Post-operation.—Vertigo; vomiting; occipital pain. Pulse 60. Temperature normal. Interference with co-ordination. Exaggeration of patellar reflexes. Sluggish reaction to light. Right optic neuritis.

Diagnosis.—Cerebellar abscess. Operation. Cure.

Operation.—Trepanation upon the cerebellum, and incision of temporal and cerebellar lobes negative.

Second Operation.—Evacuation of cerebellar abscess in the direction of the internal meatus.

138. WAGGETT (*Trans. of the Otol. Soc. of the United Kingdom*, 1900).

Waggett mentioned in the discussion a case in which aural suppuration persisted for months after the evacuation

of a cerebellar abscess, and ceased on the spontaneous extirpation of a cochlear sequestrum.

139. ZIA NOURY (*Annales et Bulletin de Statistique*, Constantinople, 1904).

Case of cerebellar abscess.

140. BURGER (*Dänische Otol. Gesells.*, 1904) reported on 22 cases of cerebellar abscess, of which 7 were cured.

141. POLITZER'S CLINIC. Girl aged 19.

Chronic Left Otitis Media.—Occipital pain; no fever; staggered on walking with the eyes closed. *Left Ear*: Meatus contracted; muco-purulent secretion; painful cicatrix over mastoid process. Sinus thrombosis; ligature of jugular. Cure.

Operation.—Tympanic cavity full of granulations.

142. POLITZER'S CLINIC. Man aged 36.

Chronic Right Otitis Media.—Intense pain on right side; no vertigo; no vomiting. Temperature 37.4° . Pulse 72. Fundus oculi not examined. Right facial paresis.

Post-operation.—Intense pain; vomiting; horizontal nystagmus to right; right hemiparesis; right reflexes exaggerated; stupor.

After second operation: Increasing stupor. Death.

Radical Operation.—Granulations and cholesteatoma in antrum. Plastic operation. Dressing.

Second Operation.—Exposed dura apparently intact. Incision of temporal lobe negative. Exposure of posterior cranial fossa. Sinus not examined. Six tablespoonfuls

of foetid pus obtained on incision of cerebellum. Drainage. Dressing.

Post-mortem.—Ichorous abscess of entire right cerebellar hemisphere. Purulent basal meningitis.

143. POLITZER'S CLINIC. Man aged 28.

Chronic Left Otitis Media.—Brought in in an unconscious condition.

Post-operation.—Afebrile. Right optic neuritis; horizontal nystagmus to the left; vomiting. Death.

Radical Operation.—Mastoid process and antrum full of pus and cholesteatoma. Lateral wall of sigmoid sinus gangrenous. Removal of ichorous thrombus from sinus. Tamponage. Plastic operation. Dressing.

Post-mortem.—Thrombo-phlebitis of sigmoid and transverse sinuses. Abscess in left cerebellum.

144. POLITZER'S CLINIC. Boy aged 13.

Chronic Right Otitis Media.—Rigor. Torticollis. Temperature 39.2°.

Post-operation.—Afebrile. Later intense headache. Fundus oculi not examined. Death.

Operation.—Cholesteatoma in mastoid process and antrum extending to sinus. Opening of thickened and discoloured sinus, which was full of ichorous thrombi. Tamponage. Dressing.

Post-mortem.—Thrombo-phlebitis of sigmoid sinus. Thrombosis of jugular; abscess of entire right cerebellar hemisphere.

145. POLITZER'S CLINIC. Man aged 28.

No apparent ear trouble. Suddenly pricking in right ear; headache; vertigo; vomiting. Temperature 38.6°.

Pulse 72. Reflexes diminished. Thick pus in right ear. Stupor. Stiffness of neck. Fibrillary tremors in region of right facialis.

Post-operation.—Temperature 37.6°. Stupor. Restlessness. Death due to paralysis of respiration.

Operation.—Pus in mastoid process. Antrum normal. Wall of sinus discoloured. Fluid blood obtained on incision. Large suppurating cavity in a median direction from the sinus. Evacuation of pus. Tamponage. Dressing.

Post-mortem.—Purulent meningitis of right half of skull. Ichorous thrombo-phlebitis of right sigmoid sinus. Ichorous abscess of right cerebellar hemisphere. Hæmorrhagic encephalitis.

146. POLITZER'S CLINIC. Man aged 42.

Chronic Right Otitis Media.—Headache; vertigo; vomiting; stupor.

Post-operation.—Vertigo; vomiting; fundus oculi not examined. Somnolence.

After second operation: Death.

Operation.—Opening of mastoid process and antrum, and removal of granulations. No pus. Dressing.

Second Operation.—Exposure of dura. Dura intact. Incision of temporal lobe negative. Exposure of posterior fossa and incision of cerebellum negative. Sinus intact. Dressing.

Post-mortem.—Right cerebellar abscess and meningitis purulenta.

147. POLITZER'S CLINIC. Man aged 30.

Chronic Left Otitis Media.—Intense headache; stiffness of neck. Temperature 37°. Fundus oculi normal. Stupor. Death.

No operation.

Post-mortem.—Thrombo-phlebitis in sigmoid sinus and left cerebellar abscess.

14S. POLITZER'S CLINIC. Man aged 26.

Chronic Left Otitis Media.—Fever and rigors. No vomiting. Headache. Cholesteatoma in left auditory meatus.

Eleven Days after Operation.—Severe headache; vomiting; left pupil contracted.

After second operation: Both pupils equal. Rapidly progressive improvement. When in the best general condition, sudden appearance of severe meningitic symptoms. Temperature 41° . Stiffness of neck. Rigors. Coma. Death.

Operation.—Pus in antrum. Dura covered by granulations. Exposure of transverse sinus. The latter not examined. Dressing.

Second Operation.—Incision of dura of middle fossa and temporal lobe negative.

Post-mortem.—Old abscess the size of a hazelnut in left cerebellar hemisphere. Large cicatrix in right temporal lobe, and a smooth-walled cyst towards the extremity of the temporal lobe. Thick foetid pus in the abscess, which was surrounded by a dirty greyish-yellow ridge.

Left Ear.—A small quantity of thin fluid secretion in tympanic cavity. After this had been mopped out, the bone, which was exposed at the radical operation, was seen to be covered by a thin layer of granulations. The inner wall of the tympanic cavity was everywhere intact; the recesses of the fenestra were filled by a thin cushion of granulations, and the head of the stapes was seen projecting above the granulations in the oval window. The

exposed dura of the middle fossa was also covered with granulations on its tympanic side, as was the dura of the posterior fossa and the lateral wall of the sinus. The cerebral surface of the dura in the neighbourhood of the upper pyramidal surface was smooth and glistening, and of normal consistency. In the region of the prominence of the superior semicircular canal, however, the dura appeared to be raised by a superficial prominent eminence measuring 7-8 mm. in transverse diameter, and in its longitudinal diameter extending forwards as far as to the corresponding point of the exposed dura, and backwards to the superior petrosal sinus. The dura on the posterior pyramidal wall, from the anterior margin of the internal meatus, showed pachymeningitic change throughout its whole extent. A lentil-sized fistula was visible about $\frac{1}{2}$ cm. laterally and downwards from the internal meatus, with a necrotic, and in some places granulating, margin. The circumference of the fistula was covered by thick pachymeningitic deposits. It formed a direct connection between the prominence found in the middle fossa and the abscess situated in the lateral lobe of the cerebellum. In the depth of this fistula, which was filled with necrotic shreds of tissue, rough bone could be palpated by the probe.

149. POLITZER'S CLINIC. Boy aged 11.

Chronic Left Otitis Media.—Mastoid process painful on pressure. Small suppurating fistula on upper and posterior wall of meatus. Granulations in the deep parts. Temperature 40.2° . Stupor. Pupils react sluggishly. Eyes not examined. Stiffness of neck. Reflexes absent.

Post-operation.—Temperature 37.4° . Stupor. Death.

Operation.—Fætid pus and cholesteatoma in mastoid

process and antrum. Tegmen tympani infiltrated by granulations and cholesteatoma. Exposure of sinus, which pulsated. No hæmorrhage on incision of sinus. Sinus thrombosed. Opening and clearing out of sinus. Profuse hæmorrhage, due to injury to sinus; tamponage.

Post-mortem.—Ichorous abscess of left cerebellum. Meningitis at base of brain. Ichorous thrombo-phlebitis of transverse sinus.

150. POLITZER'S CLINIC. Girl aged 11.

Chronic Right Otitis Media.—Restless sleep; tremors; vomiting. No fever. Tenderness on percussion of right side of head. Stiffness of neck. Horizontal nystagmus. Vertigo; ataxic gait. Ataxia of right upper and lower extremities. Eyes not examined.

Post-operation.—Slight icterus. Somnolence. Extension of pulmonary phthisis. Articulatory disturbances of tongue. Death.

Operation.—Evacuation of a cerebellar abscess.

Post-mortem.—Abscess in right cerebellar hemisphere. Circumscribed purulent meningitis on lower surface of right cerebellum; hernia of right cerebellum. Erosion of a vessel in abscess wall—the latter dense. Extensive pulmonary phthisis. Dark blackish-red blood coagulum on lower surface of cerebellum, over right superior crus, which was connected with a pea-sized hæmorrhage of the abscess wall.

151. POLITZER'S CLINIC. Girl aged 19.

Chronic Left Otitis Media.—Rigor; movements of neck painful; position of torticollis towards left; tender on percussion. Drags feet in walking; deviates towards the left. Romberg negative.

Post-operation.—Somnolence. Stupor. Death.

Operation.—Tympanic cavity full of granulations. Tegmen softened. Dura injected. Sinus wall discoloured. Ligature and resection of thickened and discoloured sinus. Exploration of cerebellum negative.

Post-mortem.—Circumscribed purulent meningitis over apex of left temporal lobe and over pons. Abscess size of hazelnut in left cerebellar hemisphere. Purulent thrombophlebitis of left petrosal sinus and both cavernous sinuses. Prolapse of brain substance on outer side of left temporal lobe.

152. POLITZER'S CLINIC. Male aged 19.

Chronic Otitis Media and Hardness of Hearing on Left Side.—Headache; vomiting. Temperature 37.6° – 38.5° . Left facial paresis. Granulations in left auditory meatus.

Post-operation.—Severe headache, especially in occiput. Fundus oculi not examined.

After second operation: Strabismus divergens. Reflexes exaggerated. Clonic spasms in left upper extremity. Sluggish reaction of pupils. No difference in pupils. Temperature 39.4° . Death.

Operation.—Cholesteatoma and granulations in mastoid process, tympanic cavity, and antrum. Dressing.

Second Operation.—Pus exuded from necrotic labyrinth. Exposure of sinus, which was intact. Dressing.

Post-mortem.—Abscess in left cerebellar hemisphere. Meningitis diffusa suppurativa.

153. POLITZER'S CLINIC. Man aged 42.

Chronic Left Otitis Media.—Patient was brought in in a very dazed condition. Headache. Frequent hæmor-

rhage from left ear. Recent facial paralysis. Attacks of choking a few days previously. Blood mixed with pus exuded from left ear. Burrowing abscess beneath lobule of ear. Right ear normal. Temperature 40° . Death.

Autopsy.—Extensive ulcerative destruction of left petrous bone and occipital bone. Erosion of left sigmoid sinus and severe hæmorrhage. Abscess of left cerebellar hemisphere, and leptomeningitis.

154. POLITZER'S CLINIC. Man aged 27.

Chronic Right Otorrhœa.—Vertigo; vomiting; headache; loss of appetite. *Right Ear:* Tympanic cavity full of cholesteatoma and granulations. Pupils unequal. Fever.

Post-operation.—Intense headache; somnolence; bradycardia. Death.

Operation.—Exposure of dura of middle fossa, which was intact.

Second Operation.—Exposure of sinus, in doing which a large movable sequestrum was met with. It contained the labyrinth, the cochlea, and the semicircular canals. Dura here normal. Incision with Preysing's knife negative.

Post-mortem.—Nut-sized encapsuled abscess in right cerebellar hemisphere, near a smaller recent abscess. Subdural suppuration in right petrous bone, due to perforation resulting from necrosis after purulent otitis media. Ascarides.

155. POLITZER'S CLINIC. Girl aged 17.

Chronic Otitis Media and Hardness of Hearing in Left Ear.—Pain in left ear; vertigo. Pulse 88. Granulations in tympanic cavity.

Post-operation.—No fever. Vomiting; pain in forehead; prostration. Left disc hyperæmic; taches cérébrales. Reflexes exaggerated. Pain on pressure over cervical vertebræ. Pulse 96. Temperature 38.7°. Right facial paresis. Strabismus.

After second operation: Strabismus. Pulse 88; arrhythmical. Death.

Operation.—Bone sclerosed. Cholesteatoma in attic. Malleus and incus carious. Sinus intact.

Second Operation.—Exposure of dura over tegmen tympani. Incision through intact dura negative. Small prolapse of brain immediately excised. Enlargement of operation wound posteriorly and downwards. Exposure of sinus, which was normal. Puncture of exposed cerebellum negative.

Post-mortem.—Prolapse of temporal lobe through trepanation opening, with purulent inflammation of this and the adjoining portions of the left temporal lobe. Abscess of cerebellum, occupying the superior vermiform process, with compression of the fourth ventricle. Chronic hydrocephalus internus.

156. POLITZER'S CLINIC. Male aged 17.

Chronic Right Otitis Media.—Emaciation; vomiting; headache; no vertigo. Subjective aural tinnitus on right side. Reflexes not investigated. No nystagmus (Dr. Bárány). Pus and cholesteatoma in right ear. Movement of head painful. Skull not painful on palpation. Speech hesitating.

Post-operation.—No vomiting; no nystagmus; complete facial paralysis. Ataxia of the right upper and lower extremity. Headache; stupor. Pulse 60. Paresis of left abducens. Babinsky plantar reflex. Hypotonia of all

extremities. Convergent strabismus. Rotatory nystagmus towards right; bilateral choked discs; paresis of right abducens; vertigo in left lateral position.

After second operation: Stupor. Death.

Operation.—Tympanic cavity, attic, and antrum, full of cholesteatoma. Fœtid pus exudes in front of sinus. Dura at sinus intact. Exposure of posterior fossa, which resulted in the evacuation of fœtid thick pus. Walnut-sized abscess in cerebellum. Ablation of labyrinth. Opening of vestibule. Nothing pathological in labyrinth. Opening of cochlea from promontory. Findings negative. Dressing.

Second Operation.—Removal of entire pyramid. Labyrinth everywhere infiltrated by granulations. Exposure of dura behind sinus. Drainage. Dressing.

Post-mortem.—Abscess of right cerebellar hemisphere, extending up into superior vermiciform process. Recent purulent meningitis in neighbourhood of right temporal lobe and right cerebellar hemisphere.

157. POLITZER'S CLINIC. Woman aged 20.

Chronic Left Otitis Media.—Temperature 40°. Stinking pus and granulations in meatus.

Post-operation.—Nystagmus on looking towards left; vertigo. Objects appear to move towards the sound side. Frontal pain. Death.

Operation.—Cholesteatoma in tympanic cavity. Exposure of posterior fossa. Dura itself thickened and infiltrated by granulations. Dura exposed as far as the horizontal semicircular canal. Large deep extradural abscess on posterior pyramidal surface. After excision in layers of the posterior pyramidal wall the dura was incised. The exposed anterior extremity of the cerebellum showed

a perforation, which was dilated by dressing forceps. Tamponage of cavity. Division of sinus and removal of thrombi. Tamponage.

No change of dressing. Puncture of cerebellum with dressing forceps and evacuation of abscess.

Post-mortem.—Nut-sized abscess of right cerebellar hemisphere. A second somewhat smaller foetid abscess close to the first. Foetid thrombo-phlebitis of left transverse sinus.

158. POLITZER'S CLINIC. Man aged 21.

Chronic Right Otitis Media.—Foetid pus in right ear. Swelling and tenderness on pressure behind mastoid process. Temperature and pulse normal. Nystagmus on looking to left.

Post-operation.—No vertigo. Nystagmus to left. Cure.

Operation.—Cholesteatoma, pus, and granulations, in mastoid process, extending to sinus. The same applies to the tympanic cavity, attic, and antrum. Sinus discoloured, and infiltrated by granulations. Opening and drainage of sinus. Plastic operation. Dressing.

Change of Dressing.—Pus exuded on raising the dura. On introducing a probe it passed into the cerebellum. A coffee-spoonful of pus was evacuated from the cerebellum. Incision of dura and cerebellum behind the pyramid, commencing in the region of the median wall of the sinus. Tamponage. Dressing.

Bacteriological Investigation.—Anaërobic bacilli.

159. POLITZER'S CLINIC. Man aged 32.

Chronic Left Otitis Media.—Headache; vomiting; fever; vertigo. Foetid pus in left ear. Exceedingly severe nystagmus from left to right (Dr. Bárány). Intense

vertigo on walking and standing. Pulse 60. Temperature normal. Stiffness of neck. Discs not examined.

Post-operation.—Pulse 60. Paresis of left abducens. Nystagmus to right and left (Dr. Bárány).

After second operation: Restlessness. Pulse 120. Death.

Operation.—Cholesteatoma in antrum and tympanic cavity. Dura intact. No fistula.

Second Operation.—Exposure of sinus, which pulsates and is normal. Exposure of dura of posterior fossa, resulting in the evacuation of some foetid pus. On excision of the posterior pyramidal wall, foetid pus exuded under high pressure. Labyrinth removed as far as vestibule. From the cerebellar abscess, which was already broken down, about one and a half tablespoonfuls of pus were obtained. Another opening was made behind the sinus, after previous excision of a portion of the tabular part of the occipital bone. Dressing.

Bacteriological Diagnosis.—Anaërobic bacilli.

Post-mortem.—Chronic abscess of left cerebellar hemisphere. Diffuse purulent meningitis. Abscess surrounded by a thick membrane. Circumference of abscess encephalitic. Hydrops of ventricle.

160. POLITZER'S CLINIC. Girl aged 17.

Chronic Right Otitis Media.—Fever; headache; rigors; vertigo. No vomiting. Pulse 120. Temperature 39.8° . Stupor. Reflexes, eyes and pupils—not examined. *Right Ear:* Tympanic cavity infiltrated with foetid pus and cholesteatoma. Horizontal nystagmus on looking towards right, and rotatory nystagmus on looking towards left. Iodophile leucocytes in lumbar puncture.

Post-operation.—Temperature 37.7° . Pulse 92. No vomiting. Rigidity of neck. Mydriasis. Stupor.

After second operation : Temperature 38.6° – 39.1° . Pulse 135. Death.

Operation.—Ligature of jugular and facialis communis. Fluid blood obtained on division.

Radical Operation.—Fœtid cholesteatoma and granulations in antrum and attic. Bone partially destroyed, partially softened. Deposit of discoloured granulations on dura of middle fossa. Evacuation of pus from defect in dura. Incision of temporal lobe negative. Removal of superior pyramidal margin and extensive exposure of sinus, which was discoloured. Fluid blood obtained on incision of sinus. Tamponage. Plastic operation.

Second Operation.—Prolongation of incision upwards and downwards. Removal of suppurating thrombus from sinus. Clear fluid escaped from dural fistula. Dressing.

Post-mortem.—Nut-sized abscess in right temporal lobe, bordered by membrane 1 mm. in thickness. Small nut-sized abscess in lateral portion of right cerebellar hemisphere. Pus in lateral ventricles. Purulent leptomeningitis of basis. Also a small epidural abscess on anterior and posterior pyramidal surface. The dura corresponding to the posterior epidural abscess was necrotic at circumscribed points. Dark blood-clot in the sigmoid sinus.

161. POLITZER'S CLINIC. Man aged 20.

Bilateral Chronic Otitis Media.—Headache; vertigo; nausea; fever. *Left Ear*: Severe fœtid suppuration from attic. *Right Ear*: Residuum of chronic suppuration. Handle of malleus firmly adherent to promontory.

Post-operation.—Temperature 39.7° . Headache; vertigo. Three weeks later high fever. Pupils contracted; react sluggishly. Nystagmus. Veins of right papilla

dilated. Rotatory nystagmus from right to left. Severe nystagmus on looking towards the side operated upon; less severe on looking towards the normal side. Diplopia on looking towards the affected side.

After second operation: Somnolence; nystagmus. Sudden death due to paralysis of respiration.

Operation.—Dura corresponding to antrum exposed, but intact. Tympanic cavity, attic, and antrum, full of granulations. A bony shell, passing from the tegmen tympani in a posterior direction, was full of caseous masses. Necrotic point at horizontal semicircular canal. Exposure of sinus in region of mastoid process. Plastic operation. Dressing.

Second Operation.—Exposure of sinus and dura of middle fossa. The carious part is broken down at the horizontal semicircular canal; the suppuration has extended into the labyrinth. Removal of affected portion. Dressing.

Autopsy.—Plum-sized abscess in left cerebellar hemisphere. Meningitis purulenta. Acute cerebral œdema. Parenchymatous degeneration of internal organs. Splenic tumour.

162. POLITZER'S CLINIC. Female.

Chronic Left Otitis Media.—Pain in left ear; decrease of hearing power; vertigo. Occasional diplopia. Vomiting. Patient walks "as if she were drunk." In attacks of vertigo everything rotates to the right. Constipation; emaciation. Rotatory nystagmus on looking to left; left facial paresis. Fundus oculi not examined. Reflexes exaggerated. No ankle clonus.

Post-operation.—Vertigo; vomiting; rigidity of neck. Pulse 132. Death.

Operation.—Granulations in antrum and tympanic

cavity. Dura intact. Bone over sinus diseased. Sinus discoloured. Injury to sinus. Tamponage. Dressing.

Second Operation.—Exposure of posterior fossa in front of sinus; the latter did not pulsate. On elevating the dura, pus was seen on the median pyramidal surface behind the horizontal semicircular canal. Opening of horizontal semicircular canal, in which no pus was found. Dura here discoloured, and infiltrated with granulations in region of aquæductus vestibuli. Removal of bone as far as porus acusticus internus. Incision of dura with Preysing's knife negative.

Post-mortem.—Transverse sinus not examined. In left cerebellar hemisphere a cavity the size of a pigeon's egg, full of foetid masses, and covered by a membrane about $\frac{1}{2}$ mm. in thickness. Encephalitic change had occurred in the neighbourhood of the abscess. Ependyma delicate.

163. POLITZER'S CLINIC. Man aged 30. Received January 24, 1905.

The patient had suffered for two and a half years from left otorrhœa, associated with intense pain. Eight months before admission polypi were removed from the left ear, but the suppuration was not influenced by this.

He complained of headache; rotatory vertigo, fever, and rigors. *Present State:* Graceful build; emaciated; general debility; sensorium clear. Placed in bed. No stiffness of neck. No tenderness on pressure of nape of neck and cervical region. Head freely movable. Prompt reaction of pupils. Pulse 102; regular.

The patient complained of severe pain in the frontal region. On the previous day there was pain in the left temple and left ear. Mastoid process and skull not painful on palpation. Rotatory nystagmus from right to left on

looking to the right ; less towards the left. Vertigo ; everything rotates from right to left. No abnormality in facialis. The patient can only walk with support, owing to weakness ; no oscillation on standing with closed eyes.

Right Ear.—Not examined.

Left Ear.—Total destruction of the drum ; firm adhesions. Fœtid suppuration.

Rinne positive. Air conduction absent.

Operation under chloroform narcosis (Dr. Neumann).

1. *Lumbar Puncture.*—About 10 c.c. of clear fluid obtained.

2. *Radical Operation.*—Eburnization of mastoid process. Antrum dilated towards the back, and covered by hard granulations. Characteristic black pigmentation of bone. Fistula found at horizontal semicircular canal. On proceeding backwards fœtid pus escaped from region of sinus. Exposure of sinus, which is thrombosed. Severe hæmorrhage from mastoid emissary. Tamponage.

3. *Opening of Labyrinth.*—In it were blackish masses. Vestibule opened from behind, in doing which the facialis was completely exposed at the corpus geniculatum, so that about $1\frac{1}{2}$ cm. of it projected freely through the tympanic cavity. Opening of fenestra ovalis and promontory.

4. Exposure of sinus to above the corpus geniculatum, and nearly to the bulbus. On slitting the sinus below, thrombosis was discovered ; blood escaped on slitting it at the corpus geniculatum. Tamponage.

Ligature of jugular. This was very full ; it was doubly ligatured and sutured. Double ligature of anterior facial vein. Closure of the wound in the skin by clamps. Dressing.

January 25: Rotatory nystagmus from right to left

somewhat less than before the operation, but otherwise of the same character. Slight vertigo; no headache thirst; slight vomiting. Complete facial paralysis.

January 28: Dressing changed. Jugular incised. Fluid blood streamed out; the sutures were loosened and the peripheral stump ligatured. No reaction in the wound. Suppuration in exposed labyrinth.

January 29: Good general condition. The patient has a good appetite and sleeps well; no pain.

January 30: The patient has slept well. Slight pain in wound. Dulness. No headache. Temperature 37.1° .

January 31: *Status idem*.

February 1: Headache. Nystagmus remains the same. Dressing changed. Sterno-cleido-mastoid granulating. Some deposit on peripheral stump of jugular. Ligature not yet thrown off. Retro-auricular wound granulating, and shows deposit in places. Secretion of pus apparently increased in labyrinthine cavity.

February 3: Patient has not slept. Pain in forehead and vertex. Pain in right ear. Nystagmus the same. No sugar or albumin in urine.

February 4: Headache increased, especially in occiput. Patient visibly going downhill. Pulse 69. Horizontal nystagmus especially severe on looking to left; slight on looking to right. Patient vomits a good deal (fairly difficult). On February 3, after changing the dressing, slight nystagmus on looking to the left was noticed, which had never been observed before.

Operation in the evening under chloroform narcosis (Dr. Neumann). Removal of pyramid so as to expose dura of posterior fossa. In doing this a little pus escaped between the posterior pyramidal surface and the dura. The saccus endolymphaticus and aquæductus

vestibuli were exposed by retraction. The saccus endolymphaticus was carious and infiltrated by pus. The posterior semicircular canal was removed, in order to expose the bulb of the jugular vein, the bony margin of the internal auditory meatus also becoming visible. The wall of the lateral sinus was incised, and the dura behind the sinus exposed. The latter was seen to be normal. An incision about $2\frac{1}{2}$ cm. in length was then made in the dura of the posterior fossa in front, and perpendicularly upon the sinus. Preysing's brain knife was then introduced, and this resulted in the immediate evacuation of very foetid pus, mixed with shreds of tissue and a large quantity of blood. Dressing forceps and the little finger were introduced into the aperture, more pus being evacuated. Tamponage and dressing. Pulse 60; strong. Respiration superficial. *Post-operation*: No headache. Senses clear; very feeble.

February 5: No headache; quiet sleep; vomiting and nystagmus still very severe. Pulse strong; regular.

February 6: Severe headache; no vomiting. Dressing changed. Labyrinthine region full of very foetid pus. Removal of drainage-tube. Patient feels better. Persistent severe nystagmus. In the evening terrible headache. Subcutaneous injection of 1 per cent. morphia. Procured comfortable sleep.

February 7: Relatively well.

February 11: Patient feels again worse. Severe headache; vomiting.

February 12: Intense headache. Evacuation of some pus on changing the dressing. The patient groans, and is unable to sleep in spite of morphia.

February 13: *Status idem*. Patient is dazed. Pulse 63. Respiration superficial, with long intervals. Wound

exposed. The forceps were introduced into the abscess cavity to a depth of about 3 cm., this resulting in the immediate evacuation of a large quantity of extremely foetid pus in a stream. Tamponage. Dressing. Head placed low. Slight collapse. Slight improvement in evening. No headache. Pulse rate higher: respiration deeper and more frequent.

February 14: Nystagmus less. No headache. Pulse 90: strong, regular, full. Respiration good.

February 15 and 16: Occasional vomiting of nauseous pus. Coffee-spoonful of pus evacuated from abscess cavity on changing the dressings.

February 17: Nystagmus on looking to right and left. Complained spontaneously of vertigo on sitting up.

February 20: Foetid pus in moderate quantity still continues to be evacuated from the abscess cavity.

February 26: Frequent vomiting.

February 28: Patient much emaciated; given nutrient enema.

March 2: Patient always lies on right side; vertigo in left lateral position. Nausea and vomiting on movement of the head; nystagmus on looking towards the affected side. Evening: Operation under slight chloroform narcosis. Incision of 4 cm. in a backward direction perpendicularly on the original skin incision. Exposure of dura over an area as large as a five-kronen piece behind that previously exposed. Incision of dura. On introducing dressing forceps a cavity was discovered behind the first abscess, from which shreds of tissue and ichorous material were evacuated. Drainage. Dressing.

March 3: Patient very restless; repeated vomiting; spontaneous escape of urine; occipital pain. Nystagmus the same.

March 5 : Progressive improvement.

March 25 : Discharged cured.

164. POLITZER'S CLINIC. Man aged 38.

Chronic Left Otitis Media.—Headache ; vomiting ; vertigo. Staggering gait. Aural tinnitus. Left facial paresis. Arrhythmia of pulse.

Post-operation. — Temperature 38.5° – 39.5° . Pain on right side of head.

After second operation : Temperature 38.4° . Delirium. Vomiting. Stupor. Nystagmus. Strabismus divergens.

Sudden death, due to paralysis of respiration.

Operation.—Cholesteatoma in antrum. Chiselling away of inner wall of auditory meatus. Dressing.

Second Operation.—Exposure of middle fossa. Dura normal. Clear fluid obtained on incision. Dressing.

Post-mortem.—Abscess of left cerebellar hemisphere. Basilar meningitis.

165. POLITZER'S CLINIC. Man aged 38.

Chronic Right Otitis Media.—Headache ; slight ptosis on the left side since childhood. Romberg indicated, with subjective symptoms of vertigo. No ataxia. *Right Ear :* Full of granulations.

Post-operation.—Apathy. Reflexes exaggerated. Vertigo ; amnesia. Pupils contracted ; refractory to light. Stupor. No rigidity of neck.

After second operation : Pulse delayed. Pupils unequal. Nystagmus ; mydriasis. Ankle clonus. Nystagmus to left. Cure.

Glycosuria throughout the whole course of the illness.

Operation.—Antrum, attic, and tympanic cavity, full of granulations.

Second Operation.—Dura hyperæmic. Exploration of temporal lobe negative. Dura of cerebellum covered by granulations. Pus escaped on incision under severe pressure. On digital exploration, a walnut-sized abscess with broken-down walls was discovered. Drainage. Dressing.



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